ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

What in the World!

More news about the utility "yardsticks" of the government. When will the public realize that this subsidized competition is destroying far more than it is creating? Also, how can Secretary Ickes grant money on a "sound and economical" basis to build subsidized municipal plants in towns already served by private enterprise? Why not take off the mask and say frankly "we are going to put over government ownership."

●

We wish we had space to deal with the current speeches and discussions on collective bargaining. It is a real problem when it is understood that the vast majority of industry units consists of small enterprises in which the employer and the employees operate on a personal relationship basis. What will organization gain for these enterprises and how shall it be made? Note, also, that several utilities are going through the throes of trying to develop formal employer-employee organizations. Much will be lost, but maybe all this artificial regimentation may lead to better results than those arrived at by experience over the years.

●

Then, again, the National Research Council had an interesting meeting last week, when plans were made to study the possibilities of "decentralization of industry." We are glad to see this study started by the Roper committee. In decentralization of industry and diversification of labor lies the tangible roads to recovery—at least that is our opinion.

●

We have been calling upon people about business and about new developments. As a result we promise some very inspiring and interesting information for our special January 6 issue. There is optimism and the engineering "bombs" are sure to start some loud explosions in the next year. As a friend recently remarked, "We are going to awaken pretty soon and go to work instead of talking about inflation and the NRA."

L. W. W. MORROW, *Editor*

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DECEMBER 2, 1933

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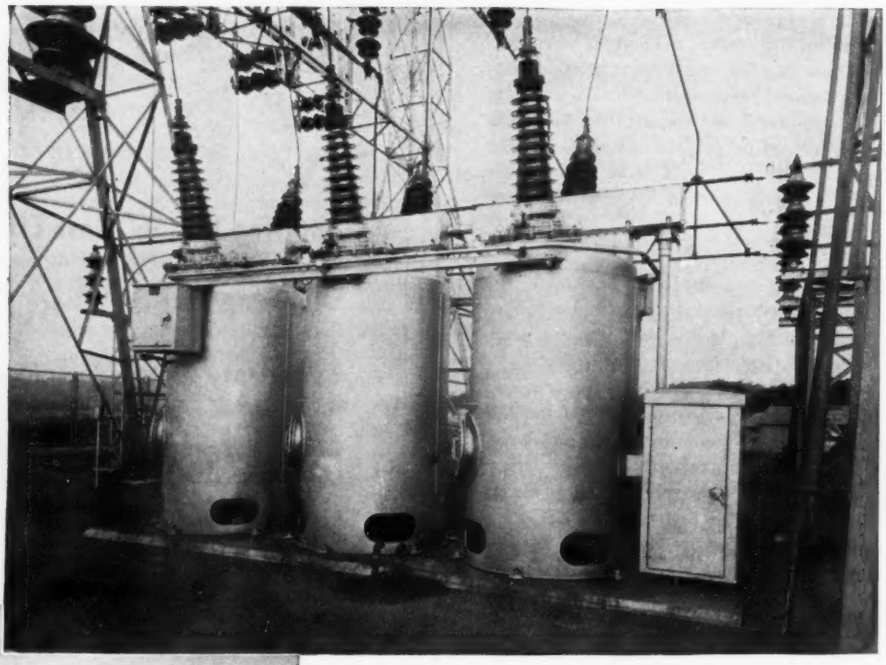
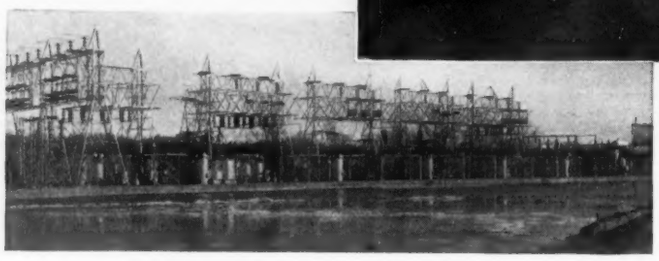
NRA MEMBER U.S. WE DO OUR PART

34 Shorts Cleared in 65 Minutes

by this G-E Oil-Blast Breaker



Type FHKO-239 oil-blast breaker at Cabot Station, rated 115 kv., 600 amp., and 1,500,000 kv-a.



A severe sleet storm, early last spring, threatened to disrupt service on the Cabot-Pittsfield line of the Turners Falls (Mass.) Power & Electric Company. It might have done so but for the performance of an oil-blast breaker protecting the line at the Cabot Station. This breaker successfully cleared 34 shorts in 65 minutes — one every two minutes.

Of course, there was no time for inspection or maintenance. A routine inspection, made some time later — after the breaker had interrupted several more shorts—showed that the oil-blast contacts were still in good condition and able to give much more service.

At various times before the storm the breaker had opened 8 shorts, so that in all, 44 shorts, varying from 400,000 to 1,115,000 kv-a., were cleared without any maintenance, or change of oil; and the breaker was still in condition to carry its full rated current and interrupt its full rated kv-a.

This is a typical example of the excellent performance of oil-blast breakers. You can obtain similar results by modernizing your old G-E breakers with the oil-blast construction. You will get greater interrupting ability, faster operation, and decreased maintenance. Ask our nearest sales office for detailed information applying to the modernization of your breakers. General Electric, Schenectady, New York.

NRA MEMBER U.S. WE DO OUR PART

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GENERAL ELECTRIC

ELECTRICAL WORLD

Established 1883—McGraw-Hill Publishing Company, Inc.

for the Week Ending

December 2, 1933

L. W. W. MORROW, *Editor*

The Stage Is Set

POLITICAL and economic conditions have had a very positive effect upon engineers and upon engineering equipment. During the recent period of electrical expansion the pressure upon the engineer has been to produce the results ordered, and this kept him so busy that he had little time or opportunity to study these results from the point of view of management or with respect to their influence upon public welfare.

In a sense the depression has eased this pressure upon the engineer so that he has recently had time to study more carefully the work he has done and to measure its significance. In far too many cases unemployment has brought home to him the fact that his security is linked with the management, political and economic aspects of his environment. Thus the engineer has learned about his past mistakes, has planned for better work in future and has broadened his perspective to sense the importance of his work in relation to other social and business activities. Perhaps this knowledge and this perspective are a little overwhelming because of the magnitude and complexity of the tasks ahead and perhaps this is the cause of the relatively low morale that exists in engineering ranks. This is a natural and constructive reaction, but it is temporary and does not discount the future possibilities of the influences that will be exerted by an awakened profession.

One of the dominant aspects of the awakening of the engineer is the fact that he has had little or no voice in executive decisions, even those made within the province of engineering. He has been a workman assigned to design or construct engineering structures or assemblies whose basic specifications were made by non-engineer executives. His work when completed has been turned over to non-engineer executives to administer and operate. This practice worked out with apparent satisfaction in boom times, but not during the depression, and these executives have been prone to blame the engineer for the sluggishness and the creaking that now exist in the engineering mechanisms. They condemn the creator without first having determined the errors in their basic specifications and in their methods of administration. It was not the engineer who ordered the mammoth factory, the large power station, the extended transmission system, the consolidation of working units of business. He was the man who carried out the orders. Blame should rest where it belongs, and admittedly the engineer deserves to be blamed because he so weakly and blindly carried out orders.

But this is water over the dam. The point is that engineers now should show competency to help correct the mistakes of the past. They must courageously face the facts and use their talents to recommend solutions. They must become executives, or at least be intimate counselors of executives. No superficial political action or generalized economic or social panacea will be effective to rectify the maladjustments that exist in industry. There must be direct action in demolition, reconstruction and rehabilitation. There must be changes in administration and operation. There must be acceptance of losses in order to make profits in the future. The new deal is

scenery, and must be associated with intelligent action on the industrial stage. There is a new place for the engineer in industry and, whether he likes it or his executives like it, he will be forced to take a leading part. Engineers should eagerly grasp their opportunity to render signal service in the public interest.

To sell— the industry objective

Further progress in the electrical industry depends upon its ability to sell its products and services. Up to this time the industry has grown largely because there was a consumer demand for these new conveniences and the essential activity of industry management was their production and not their sale. But now a certain degree of saturation exists in products and services and management must concern itself more definitely with the problems of selling if the industry is to expand.

The railroads, street railways, radio and other industries are often cited as parallel developments, in that for a time public demand was great, expansion was rapid, and then changed conditions brought stagnation or the development of new competition. The only true part of these parallels lies in the decrease of public demand for more electric products and services. This merely proves it is necessary for the industry to go out and sell its markets. Market data are available to show that the industry has reached a present market saturation of only some 40 per cent, and there is, therefore, an enormous possible expansion for the industry if it is able to attain proficiency in sales.

But proficiency in sales will not be obtained unless the industry reorganizes and unless managements come to realize that past policies and practices must hereafter be judged solely upon the basis of their aid in promoting sales. People and industries are not compelled to buy more electric service and more electrical products —they must be sold these things. All branches of the industry are now forced to study their business with a sales objective in mind, they are forced to operate their business as a sales activity, they are forced to adopt new practices and new forms of organization in order to sell in volume and economically in a highly competitive market.

Outcasts under the code

Retailers of electrical appliances awake to find themselves outcasts under the code. Because there is no national association that can speak for a majority of the dealers who sell electrical equipment, they have no standing in the administration of the retail code. Electrical merchandise cannot be represented on the compliance boards in the cities. The electrical trade must seek expression through the department stores and hardware merchants, who have recognition because they are organized.

Now the electrical specialty shops today sell perhaps 35 per cent of the domestic appliances, the contractor-dealer 8 per cent, and the power company merchandising departments 20 per cent. They have felt in the past that they did not see eye to eye in all matters of policy with the department stores and hardware men, who sell, say, 18 and 5 per cent respectively. To these non-electrical stores this household equipment of ours is just one line of merchandise to be sold at a profit. But the electrical man is keenly interested in the development of the electrical market. Certainly with the power company this is the dominating objective. Therefore there is growing concern over the situation.

Out of the NRA compliance boards it looks as though there will evolve in every city some sort of a council of retail merchants which will police local trade practices in the public interest. Since the electrical appliance dealers are denied the seat they naturally desire in this council, because they cannot speak as an organized group, the need has come for a national association of electrical dealers. With it they can take their place with the national organized hardware, department store, automobile accessory, drug and other trades in the more orderly self-government of their business. They can have that voice in the regulation of their own affairs to which they are entitled if they will qualify.

The simplest way to proceed would seem to be to use the membership of the local electrical leagues or associations now operating in 112 or more cities as the nucleus of a national association of electrical dealers and build on that. It is to be hoped that some action to this end may be initiated at the meeting of the National Electrical League Council soon to be held.

THE WEEK

Knoxville Votes for T.V.A. Energy

AT A SPECIAL ELECTION, November 25, voters of Knoxville, Tenn., approved by a two to one vote a $3,225,000 bond issue for a municipal electric light and power distribution system. The official final vote count showed 5,118 ballots for the municipal project and 2,567 against it. The vote was much smaller than expected. Knoxville thus becomes the first large city in the Tennessee Valley to co-operate with the Tennessee Valley Authority. Birmingham in the first test overwhelmingly turned down the proposition not only for an electric project but also for municipal ownership of any of the other utility projects, including water, steam heat and traction (ELECTRICAL WORLD, October 14, page 483).

Knoxville has applied to the T.V.A. for Muscle Shoals power and has asked the State Public Works Advisory Board for a $3,225,000 federal loan with which to finance the project. The bonds approved by the electorate at the election last week will be placed as security for the loan. T.V.A. is building a 226-mile transmission line from the Shoals to Norris Dam and power will be available to Knoxville from that line, which will come within 25 miles of the city. With the issuance of the new bonds Knoxville's bonded indebtedness will amount to more than $26,000,000 and its total debt to slightly more than $30,000,000. The city, with a population of 105,000, has a total assessed valuation of $120,000,000.

It is announced that the Tennessee Public Service Company, subsidiary of the National Power & Light Company, of the Electric Bond & Share system, which serves the city, has under consideration drastic rate reductions and, perhaps, total elimination of its street railway system to meet competition from a municipally owned electric system. Previous to the election the company publicly expressed its willingness to negotiate with the authority for use of Muscle Shoals power by means of its own distributing system. The municipal ownership advocates, however, waged their campaign on the basis of support of the T.V.A. and President Roosevelt's program for the valley, and the heavy vote in favor of the municipal plan has been interpreted as an expression of appreciation for the authority. The city has fixed no rates. A report made by an engineering firm employed by the city, however, suggested the application of the retail rates suggested by the T.V.A. for a municipality buying its service and distributing it through a municipally owned system. The engineers reported that these rates were one-half of the Tennessee Public Service Company's present schedule in every classification of service.

Sheffield contract under consideration

An agreement between Sheffield and the Tennessee Valley Authority for the use of Muscle Shoals power will be entered into as soon as certain formalities are concluded, according to an announcement made by David E. Lilienthal, in charge of the authority's electrification program. The terms of the contract under consideration are of the same character as those in the contract signed recently by the city of Tupelo, Miss. A lower wholesale rate might prevail, since no transmission line is involved. Retail rates may be much lower than those now in effect. An allotment of $230,000 has just been received by the city for the construction of lines, substations and a distribution system from the Public Works Administration. The city of Tuscumbia, Ala., which is also expected to sign a contract within 30 days, has just received an allotment of $130,000 for a similar purpose. Both allotments are of the "loan and grant" type, with the outright gift portion governing 30 per cent of the cost of labor and materials.

Construction of the Joe Wheeler Dam, 15½ miles up the Tennessee River from Muscle Shoals, was started last week. With the beginning of work on the Norris Dam and the roadway and other construction the T.V.A. monthly payroll has been increased to $150,000. Beginning December 1, 1933, the scale of wages for employees of the authority, who are on an hourly rate in connection with these dams, will be for skilled labor $1 per hour, for unskilled labor 45 cents per hour and for handy men and helpers 55 to 75 cents per hour.

Other P.W.A. developments

Unofficial intimations from Washington to the effect that Pacific Coast states have already received too great a share of P.W.A. funds may influence the outcome of a referendum vote on California's proposed $170,000,000 statewide water development program scheduled for December 19. The measure to be voted on provides for the creation of a State Water Authority with power to issue $170,000,000 in revenue bonds for undertaking a water and power development plan that includes the construction of a 320,000-kw. hydro-electric plant at Kennett on the Sacramento River and a $10,000,000 state-owned transmission line from the plant to the San Francisco Bay area. Application is to be made to P.W.A. for a loan and grant.

Senator Norris of Nebraska is preparing new legislation for a unified irrigation flood control and project for the Missouri River similar to the Tennessee Valley and Muscle Shoals project. He said he had in mind construction of dams on the Missouri River and its tributaries which, with Tennessee Valley flood control, would take care of the whole Mississippi River flood waters.

Indications are that the Grand Coulee power project will become an entirely federal project under a contract to be made between the State of Washington and the federal government, and may be administered with the Bonneville project under a Columbia River Authority patterned after the T.V.A.

Utilization by the state of Oregon of the power from Bonneville Dam has been the subject of a supplementary message by the Governor to the state Legislature, in special session. The message advocated authorizing $20,000,000 of state bonds primarily for constructing transmission lines to take Bonneville power into all parts of the state.

Reduced rates essential

It has been made clear by Washington officials of the Public Works Administration that they regard the possibility of reduced power rates as a prerequisite to the approval of loans for the erection of municipal electric power generating plants. Confirmation was made of the fact that city officials of Fort Worth, Tex., were so informed upon making inquiry as to the possibility of a loan for a municipal power plant. Officials pointed out that the rates proposed for the municipal plant were not below those charged by existing privately owned plants. They asserted that a municipal power plant that did not propose rates under the existing schedules would not constitute a sound and economic project.

Low-Cost Range Wiring Offered to Induce Sales

Electric range interests in Portland, Ore., are co-operating in a campaign to offer the public range wiring for $10 with every purchase of a new range during a campaign period from October 16 to December 23. This campaign, which required mutual agreement between the distributors, dealers, wiring contractors and power companies, was effected through the Electric Refrigeration and Cookery Council of Oregon, consisting of range and refrigerator distributors and utility companies in that state.

The wiring, which is offered at the $10 rate, the lowest price for range wiring ever offered in Portland and vicinity, contemplates a high quality job that would normally cost the purchaser $35. The balance of the cost of the job is being taken up by the various interests involved in definite, prearranged amounts. All the wiring created by the campaign is to be allocated by the Electrical Contractors' Association to its members in rotation.

The campaign is abundantly supported by advertising, the backbone of which is a newspaper campaign conducted by the two utility companies, Portland General Electric Company and Northwestern Electric Company. This advertising features only the $10 wiring and the advantages of electric cookery, with the expectation that dealers will tie in with it with advertising on the range they sell. Newspaper copy is to be supplemented by billboards, truck banners, store and window cards and bill stuffers.

This is the first such completely co-operative campaign to be conducted in the Portland territory. In it all local interests are tied up, each contributing to the cost of the campaign in the proportion to the sales made by each.

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Electric Boilers Added

Two electric steam boilers of 12,000 kw. rating each have been installed by the Provincial Paper Company of Port Arthur, Ont. Thus 16,000 hp. of hydro energy from the Nipigon River development will be substituted for an annual importation of 30,000 tons of American bituminous coal.

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Sharp Increase in Range Sales

September shipments of electric ranges by his company, according to R. B. Marshall, vice-president Electromaster, Inc., were greater than in any month since 1931. "We anticipated some letdown in the final quarter of this year," said Mr. Marshall. "On the contrary, we find that shipments for the first 45 days of this quarter are 200 per cent ahead of the total shipments of the last quarter of 1932. We attribute this increase to our policy of pricing our product in tune with the times and to our 1933 sales plan." Mr. Marshall further stated that experience showed that trial ranges can be put out as rapidly in one month as another; there seem to be no seasonal variations. "The rental trial plan operation moves the ranges directly from our factory into customers' kitchens. We feel that this is a very healthy condition in the range business."

▼

Georgia Sold 1,146 Ranges

Georgia Power Company's October 2 to November 11 range sales campaign closed with its quotas exceeded and 1,146 ranges added to the lines.

▼

Air Conditioning in Printing

By providing the offset printing plant of the Maqua Company, Schenectady, with air-conditioning equipment which brings the proper stock awaiting use to identical conditions of temperature and humidity encountered in the pressroom itself General Electric engineers eliminated the constantly attendant "paper troubles" arising in offset printing.

▼

Trial Ranges Rented by Florida Municipal

To popularize the use of electrical appliances and raise municipal power consumption the Orlando Fla. utilities commission has inaugurated a plan for allowing customers to use trial electric ranges for an indefinite period on deposit of $10, which is eventually refunded. A rental payment of $1.50 a month for carrying charge on the range is exacted. The commission is not entering the business of selling merchandise, the basic idea being to increase electrical energy use.

Any domestic customer may have one of these trial ranges upon making a service deposit of $10. The range may be kept indefinitely, but at the end of one year the $10 deposit is returned to the customer. The trial range may be removed at any time at the request of the customer and any other make substituted if so desired. The ranges are

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Latest Developments in Vapor Lamps

Wide World

With the evolution of satisfactory sodium-resisting glass the development of practical monocromatic sodium-vapor sources for various uses has proceeded rapidly (ELECTRICAL WORLD, November 25, page 675). R. D. Mailey demonstrated the lamps shown at a recent A.I.E.E. section group meeting. The two large lamps, one mounted on the case at the left and the other in Mr. Mailey's left hand, are both 15,000-lumen, 350-watt rating and are the largest yet produced. In Mr. Mailey's right hand and at the center of the table are 4,000-lumen, 75-watt sources. The lamp at the right is a 25-watt laboratory source of monocromatic light for test work.

not for sale and are maintained in good condition by the commission at no additional expense to the consumer. If during the first twelve months the consumer moves from one location to another the range is moved, but the $10 deposit is retained as compensation.

▼

New York Edison Workers Reject A.F.L. Union

Voting upon various proposals regarding unions and collective bargaining, after considerable preliminary differences (ELECTRICAL WORLD, November 4, page 579, and November 11, page 613), employees of the New York Edison and United Electric Light & Power companies overwhelmingly favored organizing outside of the American Federation of Labor or any independent union.

Milwaukee bans outsiders

Notice has been served by the Milwaukee Electric Railway & Light Company, subsidiary of the North American Company, through its president, that it would not tolerate efforts of organized labor to be recognized by the utility company.

S. B. Way told officials of outside labor unions that the electric company would continue to deal with labor matters only through the Employees' Mutual Benefit Association, a company organization.

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Power Commission Slashes Louisville Hydro Costs

More than $800,000 has been cut from the cost claims of the Louisville Hydro-Electric Company through a decision of the Federal Power Commission, issued this week. The decision also offered a sharp criticism of corporate policies and relationships.

The opinion, written by Chairman Frank R. McNinch and concurred in by all members of the commission, states an official power commission release, "deals vigorously and critically with the holding company problem in relation to the power industry. It characterizes the intercorporate contract for monopolistic control of construction and other service for operating utilities by the service company of the system as 'one of the most insidious, grievous and obnoxious' practices of the holding company device. Such is attacked as a scheme 'for the benefit of a private holding company, into whose treasury every dollar of the profits extorted from the operating company is siphoned through the holding company's wholly owned service company.' These service contracts, the opinion declares, demand searching inquiry 'to prevent collusive inflation of the capital structure of the operating utility which would be reflected in rates to consumers and increase the recapture price to be paid for the project by the federal government, a state or municipality.'

"The opinion points out the complete domination by the holding company interests of the operating company, the Louisville Hydro-Electric Company and the service company, the Byllesby Engineering & Management Corporation, through stock control and also the identity of officers and directors of these two companies and the top holding company, H. M. Byllesby Company, and the subsidiary holding company, the Standard Gas & Electric Company. 'Upon these admitted facts,' says the opinion, 'there is no room for quibble or doubt that licensee had no independence of action, but that decisions made by both the licensee operating company and the service company were made by the same group of men, acting in dual, triple and quadruple capacities, responsive primarily to the holding and controlling interests.' "

Various costs disallowed

The commission disallowed a claim of nearly one-half million dollars paid by the operating company to the service company as a supervisory fee of 7½ per cent of the cost of the project under an intercorporate contract. Another item denied was $3,285 for a banquet attended by about five hundred persons, including foremen and bosses on the job and officials and citizens of Louisville. The commission also rejected an amount representing rental of buses for transportation of visitors to the project, for luncheons, soft drinks and smokes. Another claim denied was $193,164.34, the amount paid by the licensee to its affiliate service company to reimburse the latter for a loss in constructing a government dam, the use of which was leased to licensee for power purposes. The commission rejected $81,117.42 of the company's claim for interest on funds used during construction. Among other items rejected was nearly $9,000 for aeroplane photography and motion pictures of the project.

Describing the Byllesby system as a "holding company dynasty—not exceptional but typical—with absentee ownership and management and sovereignty over far-flung dominions in many states, but subject to the direct jurisdiction of none," the commission urges the necessity for the federal and state commissions being clothed with all regulatory jurisdiction possible over such holding and service companies.

The Federal Trade Commission audit shows Byllesby Service Company to have received gross income from the Louisville Hydro-Electric Company of $22,244,044.45 during the years 1922-27 inclusive, while its expenses were only $11,499,091.28. The commission, therefore, calculates that the service company made a profit of 98.5 per cent on the cost of its services, while its engineering department earned a profit of 53.62 per cent on the cost of its service during the same years.

▼

Van Der Graff Generator

In tests this week the Van Der Graff generator at Round Hill, R. I., discharged 7,000,000 volts direct current across a sphere gap. This is said to be at least three times the previous maximum available for research and experimentation in the direct-current field (ELECTRICAL WORLD, February 4, cover).

Politics and Not Economics

From an insignificant cloud, perhaps no bigger than a man's hand, in strict accordance with tradition, has developed a great thunder head which threatens the land with calamitous storm. Doubt and apprehension over the monetary policy now pursued is stirring even the most complacent assenter. Obviously something will be done. A return to the solemn promises and pledges of the sound money men is as improbable as the likelihood that the commodity dollar concept will be allowed to persist. The question appears to be at what level will there be stabilization and can, or will, that position be held? Even the worst cases of megalomania are said to yield to the desire to have succeeded—sometimes.

Those big three of the business telltales — carloadings, electrical energy production and bituminous coal production—are doing well, showing respectively, in the most recent figures available, a gain of 3.7 per cent over the preceding week; slight drop from the sustained level of the two preceding weeks and a distinct gain above the daily average of production for the week previous. General indexes show either slight gains or resistance to decline. One assumes that the pulse of trade is comparatively strong.

Prices are weak, signifying little, for the window dressing preceding the government's necessitous December 15 financing inevitably drags up the value of the depreciated dollar and reduces commodity and stock market levels. Not until that is over with, or a monetary policy with reasonable prospect of continuance is formulated, will price indexes bring much fundamental economic information.

Rumors are running of plans for a new social economy and of better national co-ordination for consideration by Congress. Be that as it may, successful politics means retaining power and control once gained and the voice of the electorate will be heard once more. Anticipation of that voice may temper the wildest of plans, whether of conservatives or radicals.

Coming Meetings

American Society of Mechanical Engineers—New York, N. Y., December 4-9. C. W. Rice, 29 West 39th St., New York.

American Physical Society, Pacific Coast Meeting—Stanford University, Calif., December 15-16. W. L. Severinghaus, Columbia University, New York.

American Institute of Electrical Engineers—New York, N. Y., January 23-26. H. H. Henline, 29 West 39th St., New York.

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Oil Industry Problems Win Utility Co-operation

Late developments in deep well drilling and pumping, in pipe line and in refinery operation, holding out prospect of large use of purchased electric power, were jointly discussed by oil and utility men at the recent annual meeting of the Petroleum Electric Power Club at Oklahoma City, Okla. There was evidenced a real need for active effort to secure uniform wording of contracts and line extension agreements, as well as types of rate structures suitable for oil field and pipe line pumping practice. A committee of the club has been working on this matter for several years and at this meeting submitted a revised report offering a basis of contract, rate form and extension agreement for general use by electric companies supplying service to these divisions of the oil industry. Through the efforts of the club sixteen power companies located in six different states were able to present quickly a uniform proposal to the Great Lakes Pipe Line Company, which resulted in the electrification of its booster stations between Oklahoma and Chicago, totaling 7,700 hp. (ELECTRICAL WORLD, November 18, 1933, front cover, and page 658.)

In a report by the committee representing electrical manufacturers various types of equipment now available for oil field service and some of the advantages and disadvantages of each were discussed. That subject, which provoked the most discussion, was the practicability and necessity for variable speed equipment for pipe line pumping work. It seems apparent that if some practical and economical method of speed variation could be obtained it would make electric service more attractive and would simplify the problem of uniform rate structure. It was clearly made evident by J. M. Brown, Oklahoma Gas & Electric Company, that a need existed for standardization of voltages, points of delivery and other service specifications in the interest of economy, both to the electric company and the oil company. Much interest has been indicated by oil company men in such standardization work and the way has been paved for the club to co-operate with other oil organizations in an effort to determine some basis for it.

W. H. Stueve, Oklahoma Gas & Electric Company, was elected chairman for the coming year.

▼

Insull Unit Reorganization Hindered by Creditors

Protracted efforts to rehabilitate the Municipal Service System, Insull holding company, controlling properties in Ohio and Pennsylvania, collapsed last week when a group of creditors of the Ohio companies failed to renew a standstill agreement that had been in effect several months.

The Ohio properties were controlled by Municipal Service through the Central Eastern Power Company. The Chase National Bank owns a $3,160,000 note of the latter company, whose common shares are pledged under Municipal Service 6 per cent bonds. This note was secured by a $3,160,000 note of the latter company, whose common shares are pledged under Municipal Service 6 per cent bonds. This note was secured by a $3,160,000 note of Central Utilities Service, an operating subsidiary, which also owes $386,667 to the Penn Central Light & Power Company, and by all common shares of Central Utilities Service. These common shares recently were acquired by the Chase bank at auction.

Certain banking funds to the account of Central Utilities Service were attached several months ago on account of the Penn Central loan. To Penn Central is owed also $342,000 by Central Eastern Power, $589,917 by Reserve Power & Light and $36,443 by Columbus, Delaware & Marion Electric Company, Central Eastern subsidiaries. The notes were indorsed by Central Eastern Power, which pledged all common stock of Ohio Electric Power and all preferred and common shares of Reserve Power & Light, its subsidiaries.

National Electric Power Company, bankrupt subsidiary of the Middle West Utilities Company, also indorsed the $2,000,000 loans extended by Manufacturers Trust and pledged 200,000 common shares of New England Public Service Company, 21 per cent of the total amount, to secure its indorsement. Manufacturers Trust is expected to proceed now to realize upon the collateral pledges under the two indorsements, and if there is a deficiency, claims for the balance due the bank will be pressed against the operating companies that issued the notes. Under the proposed plan of reconstruction these and other claims would have been compromised and new securities of the rehabilitated system would have been distributed among creditors. Inability to agree on the proportions of new securities to

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Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Kansas City Power & Light (Year ended September 30)					
Gross earnings	$14,309,529	$14,733,644	— 2.9	63	60
Net earnings	5,268,421	5,828,323	— 9.6	..	..
Net balance*	3,384,478	4,138,066	— 18.3	..	..
Milwaukee Electric Railway & Light (Year ended Sept. 30)					
Gross earnings	24,218,761	26,533,478	— 8.7	80	81
Net earnings	4,682,939	5,069,246	— 7.6	..	..
Net balance	144,965	567,495	— 74.5	..	..
Pacific Gas & Electric (9 mos. ended Sept. 30)					
Gross earnings†	64,006,095	64,773,326	— 1.2	71	67
Net earnings	18,164,015	21,277,723	— 14.6	..	..
Net balance	7,932,395	10117,465	— 21.1	..	..
Puget Sound Power & Light (Year ended Sept. 30)					
Gross earnings	12,632,203	14,061,764	— 10.2	63	61
Net earnings	4,737,473	5,519,643	— 14.2	..	..
Net balance	762,819‡	591,45	—177.5	..	..
Virginia Electric & Power (Year ended Sept. 30)					
Gross earnings	14,730,665	15,868,724	— 7.2	64	65
Net earnings	5,319,808	5,521,985	— 3.7	..	..
Net balance	2,238,004	2,464,068	— 9.2	..	..

Holding Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
American Light & Traction and subsidiaries (Year ended Sept. 30)					
Gross earnings	35,014,941	38,367,073	— 8.7	72	70
Net balance	4,728,352	6,724,754	— 29.6	..	..
American Water Works & Electric and subsidiaries (Year ended Sept. 30)					
Gross earnings	42,868,756	45,175,480	— 5.1	55	55
Net balance	2,392,927	3,499,134	— 31.5	..	..
Engineers Public Service and constituent cos. (Year ended Sept. 30)					
Gross earnings	42,855,068	47,822,763	— 10.4	64	63
Net balance	171,555	2,418,972	— 93.7	..	..
Philadelphia Company and subsidiaries (Year ended Sept. 30)					
Gross earnings	45,627,163	51,704,319	— 11.7	66	62
Net balance	3,802,886	6,067,629	— 37.3	..	..
Public Service Corporation of New Jersey and subsidiaries (Year ended October 31)					
Gross earnings	117,448,384	127,870,168	— 8.2	65	66
Net balance*	26,811,271	29,563,860	— 9.3	..	..

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

*Before all dividends. †Includes miscellaneous income. ‡Deficit.

which the creditors believed they were entitled caused the standstill agreement to be given up. It is still hoped that a reorganization of the Pennsylvania properties may be effected.

An order appointing receivers for the Arkansas-Missouri Power Company, an Insull-financed property, was recently issued in federal court in Little Rock on petition of stockholders, who claimed the company was being mismanaged.

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Extra-Legal Steps Needed to Extradite Insull

Intimations from the Greek Ministry of the Interior, in response to United States government hints that some way to extradite Samuel Insull must be found, show little inclination to override the courts, which have twice refused to return the fugitive. Threats of reprisals have left the matter to the conclusion that "If the Greek government desires to take up the case causes outside the law must be found."

To shift State Line interest?

Application for permission to shift most of the rights of the Northern Indiana Public Service Company in the State Line generating station to the Commonwealth Edison Company has been made to the Indiana Public Service Commission by Morse DellPlain, president of the former organization. The station has a capacity of 200,000 kw., of which 60,000 kw., to which the Indiana company is entitled, has for some time been resold to the Chicago utility.

At a recent joint meeting of protective committees for the 6 per cent and 5 per cent refunding mortgage stock or bonds of the Winnipeg Electric Company and for the 5½ per cent first mortgage bonds of the Manitoba Power Company, Ltd., it was decided that each committee would continue to function for a time without requesting deposit of securities. They will endeavor to negotiate a general plan of reorganization for submission to the security holders of the Winnipeg company and its subsidiaries. Each committee nominated representatives for this purpose.

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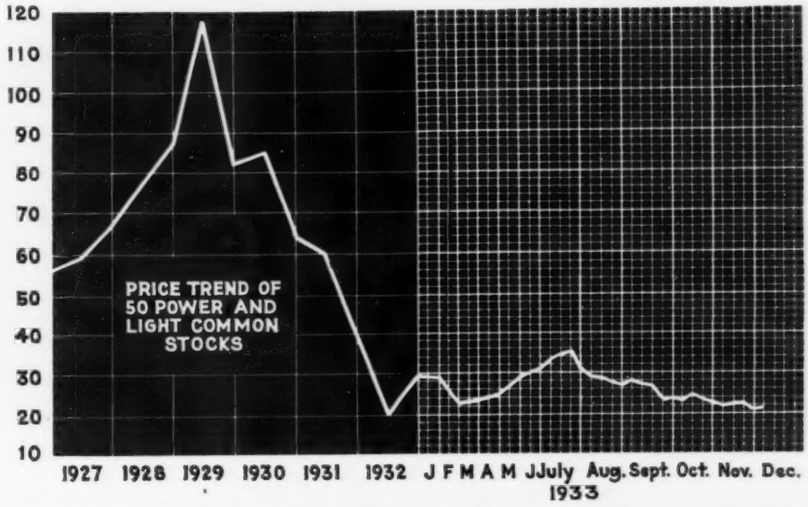
Northwest Merchandising Plans

Under the auspices of the Northwest Electric Light and Power Association energy and equipment sales plans for the coming year are being developed. A residential sales bureau will study plans for selling electric ranges as now being tried out in various parts of the country. Water heaters and home-lighting kits for selling added lighting in residences will be principal studies. An industrial and commercial sales bureau has also been established, as has a rural sales bureau.

Utility Securities Continue Decline



Light and power bonds dropped to 83.3 in the "Electrical World" average for the end of November, the lowest yet recorded; last month it was 88.2. Stocks did scarcely better this week 21.4, last week 21.0

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No Bond & Share Dividend

Directors of Electric Bond & Share Company have voted not to declare a dividend on its common stock. The last dividend was declared on November 16, 1932, for payment on January 16, 1933. The company announced then that common dividends would be acted on annually.

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Chicago Merger Postponed

Because of complications introduced through the terms of the federal securities act, the plan (ELECTRICAL WORLD, September 30, page 421; October 7, page 453) to offer common capital stock of the Commonwealth Edison Company in exchange for common stock of the Public Service Company of Northern Illinois has for the time being been postponed. It is stated that the plan has not been abandoned, but merely postponed without any important change.

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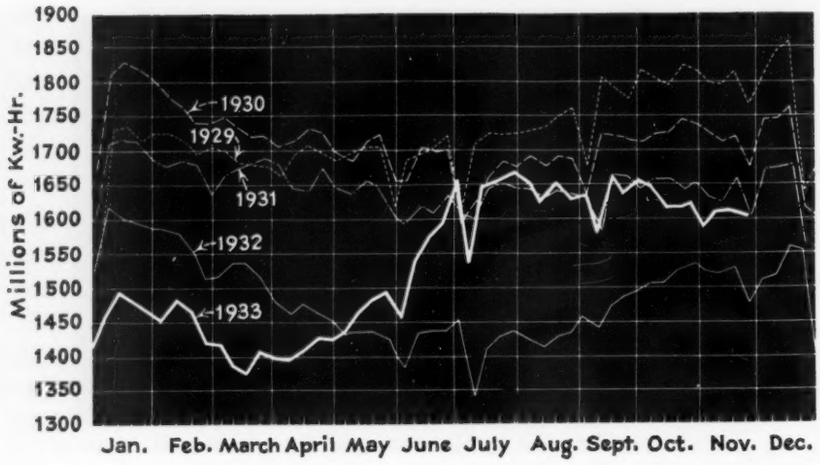
Federal Public Service Plan

Reorganization plan for Federal Public Service Corporation, Chicago holding company now in receivership, has been approved by the U. S. District Court and Federal Judge Walter C. Lindley has taken the promulgation of the plan under his supervision. The voting trust for the common stock, which is for ten years unless dissolved at a sooner period as provided in the agreement, will be administered by five trustees, of whom four will be appointed by the committee representing the first lien bonds and one to be chosen by the committee representing the 6 per cent gold notes.

Weekly Output Declines



Output of central electric light and power plants during the week ended November 25, announced by the Edison Electric Institute as 1,607,546,000 kw.-hr., declined 0.6 per cent from the preceding week.

Comparison with the corresponding week of 1932 would not be valid because in that year the Thanksgiving holiday was included, and experience has shown that this interruption of industrial operations materially affects the consumption of electrical energy. For that reason the usual percentages have been omitted from the table.

The recent downward trend, despite shorter daylight, points to moderately reduced industrial activity.

Per Cent Change from Previous Year

Region	Week ended Nov. 25	Nov. 18	Nov. 11
New England	*	+ 8.4	+ 6.6
Middle Atlantic	*	+ 4.6	+ 5.1
Central Industrial	*	+ 8.7	+ 9.9
West Central	*	+ 1.9	+ 1.6
Southern States	*	− 3.9	− 1.0
Rocky Mountain	*	+26.6	+30.6
Pacific Coast	*	+ 3.0	+ 2.6
United States	*	+ 5.6	+ 6.3

* No percentages available due to Thanksgiving holiday in 1932 week.

Weekly Output, Millions of Kw.-Hr.

1933	1932	1931
Nov. 25...1,608	Nov. 26...1,475	Nov. 28...1,600
Nov. 18...1,617	Nov. 19...1,532	Nov. 21...1,655
Nov. 11...1,617	Nov. 12...1,521	Nov. 14...1,623
Nov. 4...1,583	Nov. 5...1,525	Nov. 7...1,628
Oct. 28...1,622	Oct. 29...1,533	Oct. 31...1,652

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Wholesale Energy Output 20 per Cent Over 1932

Weekly statistics of electrical energy production, as reported by the Edison Electric Institute, while showing the fluctuations in total output, do not reveal changes in consumption by various classes of users. Monthly figures on energy sales compiled by the same organization do, however, indicate this.

Latest figures available are those for September. For the three most important groups of customers they are shown in the accompanying table, which includes also the corresponding sales in July and August for comparison. The quantities are in millions of kilowatt-hours. The figures in parentheses give the changes compared with 1932 expressed in per cent.

With shortening daylight domestic sales were beginning to rise in September and the gain over last year was increasing, but small commercial light and power sales were lagging.

Large commercial sales, directly indicative of industrial activity, at first glance point to a recession. This conclusion is changed if Sundays and holidays are taken into account, leaving 25 work-days in July, 27 in August and 24 in September. Average sales per working day, on that basis, were 132, 126 and 136 millions of kilowatt-hours, respectively.

If allowance could be made for such wholesale energy consumption as may occur on Sundays and holidays the fluctuations would be smaller, but the average for September would still be greater than for August.

Group	July	August	September
Domestic	867 (+1.5)	864 (+3.0)	940 (+3.2)
Commercial—small light and power	1,013 (+0.6)	1,014 (−0.2)	1,041 (−1.3)
Commercial—large light and power	3,310 (+29.8)	3,410 (+30.0)	3,254 (+20.6)

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British Output Rises

Continuing the trend shown for a number of months past, official returns rendered to the British Electricity Commission show expansion in the quantity of electricity generated—a reflection of more active trade returns. The expansion continued in October, the returns for that month showing 1,246,000,000 kw.-hr. to have been generated in October by authorized undertakings, as compared with the revised figure of 1,101,000,000 kw.-hr. for the corresponding month of 1932. This represents an increase of 13.2 per cent. In the first ten months of 1933 total output of authorized undertakings was 10,598,000,000 kw.-hr., compared with the revised figure of 9,742,000,000 kw.-hr. for the corresponding period of 1932, an increase of 8.8 per cent.

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Quarter Million Employees Third of a Billion Dollars

Central electric light and power company employees numbering 244,573 received $323,874,746 in salaries and wages during 1932. Continuing its series of announcements based on the latest census of the industry, the Bureau of the Census has published the preliminary statistics on employment given in the accompanying table for that year. For comparison corresponding figures have been added for the two preceding census years.

Number of Employees

	1932	1927	1922
Commercial establishments			
Wage earners	122,540	138,796	85,438
Salaried employees	103,017	95,951	50,667
Total	225,557	234,747	136,105
Municipal establishments			
Wage earners	11,580	10,809	10,212
Salaried employees	7,436	5,464	4,445
Total	19,016	16,273	14,657
All establishments			
Wage earners	134,120	149,605	95,650
Salaried employees	110,453	101,415	54,302
Total	244,573	251,020	150,762

Salaries and Wages

	1932	1927	1922
Com'l estab.	$303,052,399	$367,631,756	$194,148,121
Munic. estab.	20,822,347	(1)	18,284,534
All estab.	$323,874,746	(1)	$212,432,655

(1) Not called for on 1927 schedule for municipal plants in cities having fewer than 25,000 inhabitants.

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Canadian Output High

Electrical energy production in October in Canada at 1,617,786,000 kw.-hr. set a new high record, the Dominion Bureau of Statistics reports. On a daily basis, the report says, the output of 52,187,000 kw.-hr. was second only to 53,390,000 kw.-hr. produced in November, 1930. After adjustment for the usual seasonal variations, however, the October daily output was also slightly higher than in November 1930, although not as high as in June, July and August, 1933.

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25,000 Hp. for Slave Falls

Additional hydro generating capacity consisting of two 12,500-hp. units will be established at the Slave Falls plant of the Winnipeg Hydro-Electric System, according to General Manager J. G. Glassco, who has placed the cost of the additions at $1,500,000.

New York Metal Prices

	Nov. 21, 1933 Cents per Pound	Nov. 28, 1933 Cents per Pound
Copper, electrolytic	8.25	8.25
Lead, Am. S. & R. price	4.30	4.30
Antimony	7.25	7.25
Nickel ingot	35.00	35.00
Zinc, spot	4.85*	4.85
Tin, Straits	55.00	52.25
Aluminum, 99 per cent.	23.30	23.30

*Revised

N.E.M.A. Code Supervisors

Supervisory agencies for additional N.E.M.A. product classifications have been named by the National Electrical Manufacturers Association, in addition to those previously announced (ELECTRICAL WORLD, October 28, page 549; November 25, page 677). A. E. Treganza, Octave Blake and K. W. Nelson will cover the small specialty classification, while R. R. Machlett heads X-ray and electromedical products.

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Refrigeration Prize Award

First prize for the best trade show during National Refrigeration Week has been awarded by the National Electric Refrigeration Bureau to Kansas City, Mo. The award covers $500 in cash. The Kansas City show, sponsored by the Electric and Radio Association of that city, brought recognition of merit in three factors:

Co-operation between dealers, distributors and the Kansas City Power & Light Company.

Newspaper advertising and news handling relative to the exposition.

Attendance at the show, prospects obtained and actual sales made.

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German Lamp Patents Expire

Expiration in October of the patent held by German interests on the tungsten filament arrangement used in electric light bulbs is said to be causing considerable concern in Germany's electrical industry. The loss of patent protection is deemed especially unfortunate in view of intense international competition. In order to afford the German electric bulb industry greater protection at this critical time, it is believed that a substantial increase of import duty will be shortly enacted.

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Kelvinator Dividend

Resumption of dividends on its common stock with a 12½ cents a share declaration marks the reaction of the Kelvinator Corporation to increased sales and earnings since mid-year. The last previous payment was in February, 1927.

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Receiver for Grigsby-Grunow

Said to be the second largest manufacturer of radios in the United States and also the fifth largest maker of electrical refrigerators, the Grigsby-Grunow Company has passed into receivership upon the bankruptcy petition of various interested parties.

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Telegraph Census Shows Five-Year Changes

Mileage of underground telegraph wire increased 51.2 per cent in the five-year period 1927-1932, the Bureau of the Census announced on the basis of returns received at the recent quinquennial census of electrical industries. Overhead wire mileage changed only slightly, value of plant and equipment increased 18.7 per cent, but only two-thirds as many messages were sent in 1932 as in 1927. Revenue decreased even more.

The table presents combined statistics for land and ocean telegraph systems for 1932 in comparison with 1927. (The Western Union Telegraph Company, which operates both land and ocean systems, is counted as two companies.) The figures for 1932 are preliminary and subject to revision.

Summary, Land and Ocean Telegraphs (not including Wireless): 1932 and 1927

Item	1932	1927	Per Cent of Increase
Number of companies or systems	23	25	− 8.0
Miles of pole line, total	256,661	256,809	− 0.1
Owned	187,979	193,578	− 2.9
Leased	68,682	63,231	+ 8.6
Miles of single wire, total	2,266,054	[1]2,145,897	+ 5.6
Overhead, total	1,956,004	1,940,069	+ 0.8
Owned	1,714,275	1,682,413	+ 1.9
Leased	241,728	257,656	− 6.2
Underground	303,912	[1]200,979	+51.2
Submarine, other than ocean	6,139	[1]4,849	+26.6
Miles of ocean cable (nautical miles[2])	96,468	[1]99,074	− 2.6
Number of offices or stations	26,034	27,666	− 5.9
Estimated number of messages sent, total	158,377,660	229,582,433	−31.0
Land	147,970,088	215,595,494	−31.4
Ocean	10,407,572	13,986,939	−25.6
Number of employees	66,723	81,498	−18.1
Salaries and wages paid	$73,948,923	$99,520,357	−25.7
Revenue, total	$114,655,696	[3]$182,997,698	−37.3
Value of plant and equipment	$506,445,426	$426,698,742	+18.7

[1]Revised. [2]A nautical mile is equal to 6,080.2 ft., or 1.1515 statute miles. [3]Includes miscellaneous non-operating revenue.

Major New Construction This Week

Transformers, motors, controls, regulators, conveyors, etc., will be installed by Industrial Rayon Corporation, Cleveland, Ohio. A $1,500,000 project.

Bureau of Mines, Department of Interior, Washington, D. C., plans addition to experimental station, Pittsburgh, Pa., including installation of equipment; also extensions at experimental mine, Bruceton, Pa. Fund of $200,000 authorized.

Montana Power Company has authorized immediate surveys for 154,000-volt transmission line from Rainbow Dam station to Fort Peck dam site, about 275 miles. Power substation will be built.

Sheffield, Ala., has secured $230,000 for a transmission line to Muscle Shoals, with power substations and electric distribution system for city service.

Platte Valley Public Power & Irrigation District, Lincoln, Neb., asks bids in January for prime movers and other electrical equipment for hydroelectric generating plant on North Platte River, near Sutherland, Neb. Federal loan and grant for $7,500,000 has been secured

Lynchburg Distilling Company, Lynchburg, Ohio, plans extensions and improvements. Cost about $250,000, with equipment.

Escondido, Calif., plans city-owned electric light and power plant, and electric distributing system. Cost $260,000. Financing being arranged.

Bureau of Aeronautics, Department of Commerce, Washington, D. C., plans group of 2,000 aircraft landing fields in different parts of country, with hangars, floodlighting systems and other facilities. Fund of $10,000,000 is being arranged.

Defiance, Ohio, plans city-owned electric light and power plant. Special election called on December 5 to vote bonds for $350,000.

G.E. in a New Field

Entrance of the General Electric Company into the general sale of a lightweight oiled silk, hitherto used in its insulation plants, has been announced. The silk, made in Japan, is especially processed and is being sold through the Blossom Manufacturing Company. The fabric is used for shower curtains, raincoats and raincapes, umbrellas, beach pajamas and similar apparel.

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Washer Sales Hit Peak

Setting a record for the highest sales of household washing machines during October in the history of the industry and standing at twice the figure for October, 1932, most recent figures for sales activity as reported by J. R. Bohnen, secretary American Washing Machine Manufacturers Association, show a total of 107,404 units to have been marketed in October of this year.

As to Rates——

• Utah Power & Light Company's rate case brought before the state Public Utilities Commission by the United States government (ELECTRICAL WORLD, November 25, page 682) became somewhat complicated at a recent hearing when certain commercial and domestic users of Salt Lake City presented a petition in intervention in the case. They were permitted to intervene by President E. E. Corfman of the commission after some argument by counsel for the government, the state and the power company. The petition stated that it was the belief of the petitioners that "the rates charged in Salt Lake City and vicinity for electric current by the Utah Power & Light Company are excessive, unreasonable and unjust, and being unable themselves to pay for the cost of conducting a hearing involving the question of the reasonableness of such, hereby petition your honorable body for leave to intervene and to become associated with the plaintiff in the action now pending . . ." George M. Gadsby, general manager of the power company, agreed with President Corfman that evidence introduced by the United States government at one of the hearings constitutes a challenge to the power company. Mr. Gadsby promised full co-operation of the company in the conduct of such an investigation. Examination of the company's rate structure will involve a detailed appraisal of all the company's plant and equipment.

• Central Arizona Light & Power Company's rates will be investigated by the state Corporation Commission at hearings beginning December 5. The city of Phoenix has been closely following the preliminary survey of the physical property of the company through B. F. Carter, electrical engineer, who will also assist the city in connection with the coming hearings.

• Tucson Gas, Electric Light & Power Company, Tucson, Ariz., will soon meet a committee designated by Mayor H. O. Jaastad to deal with the utility company regarding future electric and gas rates. The city is making efforts to obtain electrical power at materially reduced prices and with this purpose is co-operating with the engineering firm of Burns, McDonald & Smith. The survey which is under way has two possibilities: either Tucson will construct its own electrical power plant or erect a transmission line to bring cheap power from the Salt River valley. A half million dollars is being sought of the Public Works Administration.

• Arizona Corporation Commission has denied the Arizona Edison Company a rehearing of the case involving the utility's rate for electricity, gas and water in Yuma. It had ordered reductions ranging from 18 to 28 per cent in the water rates. On November 16 Fred C. Jacobs, United States district judge, on complaint of the utility filed by C. L. Rawlins, solicitor for M. E. Cassidy, receiver of the corporation, issued an order temporarily restraining the reduced Yuma power rates. The complaint states that the Corporation Commission's rate order of November 1 is unconstitutional in that it takes Arizona Edison Company property without process of law and in that it sets up an unjust and unfair schedule of rates. The Corporation Commission also exceeded its statutory powers, it is charged.

• Delaware Power & Light Company has agreed to have its officials and engineers meet W. E. S. Temple, Wilmington Council's utility expert, to discuss with him the wide divergence between his report to the Mayor and Council and that compiled by Day & Zimmermann. The meeting will occur at Council's open discussions of charges of excessive rates made by several civic and business groups as well as private citizens. Any further prosecution of the investigation into the rate structure of the utility company must come from the Council. Mayor William H. Speer, in a recent report to the Council's committee of the whole, said his comparison of Wilmington rates with those of about a score of comparative cities proved to him that Wilmington's rates were fair.

• Consolidated Gas Company, top holding organization for New York City's electric light and power companies, has received a three to two ruling by the state Public Service Commission making effective for one year from September 1, 1933, the emergency reduction in electrical energy rates of 6 per cent, previously ordered but reheard. A saving of $8,800,000 to consumers is foreseen (ELECTRICAL WORLD, August 26, page 259, and succeeding issues). Rejection of the utility plea that NRA co-operation had and would increase costs was made on the ground of no final code approval by President Roosevelt and upon the contention that "one is led to conclude that the companies here involved are using the NRA as a means to boost costs and to prevent reductions in rates wholly apart from the merits of their case."

• Boston Edison rate hearings were resumed last week before the Public Utilities Commission with Frank H. Sullivan, representing one group of petitioners, stating that he was attempting to prohibit purchase of the Elevated generating station at any price; to have the free lamp service prohibited; the square foot area and "B" rate (household service) abolished; merchandising at a loss eliminated; so-called promotional activities which do not help rate "B" customers abolished and elimination of the "L" rate. He favored zoning of the Edison system by municipalities with the exception of Boston, where the D.C. area would be in a zone by itself. He also favored the elimination of the alleged practice of the company selling electricity to large users at less than cost. Speaking on behalf of another group of petitioners, Joseph Mulhern made a motion for the divorcing of his case from that of Sullivan's. Counsel Ives of the Edison company objected on the ground that this would involve duplication of the company's defense. Regarding the statement by Mr. Mulhern that the Edison gross in the first half year was the best in the company's history, Mr. Ives stated that gross did not present the true picture. Net income, he pointed out, was very much less during the first six months due to increased taxes and other charges, which resulted in a cut in the dividend. Chairman Attwill said the full board would take the motion under consideration.

• South Carolina Railroad Commission has obtained an order from Associate Justice John G. Stabler ruling that the Carolina Power & Light Company must show cause before the state Supreme Court January 8 why the reduction of electric rates under discussion for some time should not be enforced.

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Alabama Lamp Sales

In a 25-day lamp sales campaign just closed the Alabama Power Company more than doubled its quota and broke all 1933 selling records for the property. Total sales were 73,539 lamps.

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Britain Requires Marked Goods

Under an order-in-council, issued under provisions of the merchandise marks act of 1926, effective February 10, 1934, it is required that electrical accessories to be sold in the United Kingdom be marked with an indication of the country of origin. The indication of origin may be the word "Foreign," or a definite indication of the country in which the goods were manufactured or produced, such as "Made in U.S.A."

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Canadian Excess Denied

Canadian electrical circles have buzzed for months with comments upon the excess generating capacity of the Hydro-Electric Power Commission of Ontario. Chairman J. R. Cooke of the commission and Premier Henry of Ontario maintain the excess to be reasonable. Premier Henry said recently: "I am quite satified in my own mind that the power purchased and being delivered year by year, in addition to what we may have developed ourselves, will all be needed in the development of this province. During

the last four or five months there has been a distinct up-trend in power demanded by industries and private consumers." There was no surplus power in Ontario, he said, but a reserve power which was not more than the reserve carried by United States or Quebec concerns for adequate provision of their needs.

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Municipal Items

NEW BRITAIN, CONN. — Citizens' Property Owners' Association has petitioned City Council to have a referendum vote on the question of the city's borrowing money from the federal government for the purchase of the property and franchise of the Connecticut Light & Power Company.

CARBONDALE, ILL.—Illinois State Advisory Board of the Public Works Administration has approved city's application for $425,000 grant and loan for municipal light and power plant and distribution system and has sent the application to Washington for final action.

CHELSEA, MASS.—Citizens have voted 4,137 to 2,935 in favor of a referendum authorizing the construction and maintenance of a municipal electric power and gas plant. The vote, however, does not obligate city officials to take action, being merely a question of authorization. Only half the voters exercised their franchise on this point.

ST. PAUL, MINN.—Possibility of a vote on issuing bonds for the construction of municipal electric and gas plants appears, as an apparent deadlock has been reached in the negotiations between the city and the Northern States Power Company in the matter of a new franchise for the company. Since the Northern States franchise expired, some three years ago, the company has been operating under yearly temporary permits. However, the city charter prohibits the granting of more than three of the yearly permits, and for the past three months the matter of a permanent franchise has been under discussion. The company has offered somewhat reduced rates on gas and electric service, but wants its new franchise limited to a three-year period. A majority of the City Council, headed by Mayor William Mahoney, holds that the reductions offered are too small and that the franchise when agreed upon shall be in force for twenty years, and neither side will yield.

ST. CHARLES, MO.—City's application for $350,000 Federal Public Works grant and loan for municipal power plant and distribution sent to Washington for final action.

CLAYTON, MO.—City has abandoned, for the time being at least, consideration of a municipal light and power plant. Tentative estimates fixed the project cost at from $200,000 to $300,000.

MONETT, MO.—City has applied to the State Advisory Board of the Federal Public Works Administration for a $148,505 grant and loan for a municipal light and power plant.

MOBERLY, MO.—State Advisory Board of the Public Works Administration has sent city's application for a $700,000 grant and loan for a municipal power and light plant to Washington for final action.

CAPE GIRARDEAU, MO.—City has applied to the Federal Public Works Administration for a grant of $168,149 and a loan of $517,074 to finance a municipal power plant and distribution system estimated to cost $685,223.

TRENTON, MO.—City Engineer W. E. Rawls has announced that the city will apply immediately to the Missouri State Advisory Board of the Federal Public Works Administration for a grant and loan of $315,000 to finance the municipal power plant for which $250,000 in bonds were voted on November 14. Date for taking bids from contractors on construction work, equipment, etc., not finally set. Plant type not determined, but probably will be Diesel engine generators with a plant capacity of 1,300 kw. in three units, but may change to steam-generating equipment.

ONAWA, OHIO — Following recommendations of Nixon & Reynolds, Omaha engineers, City Council has taken action to change over from steam to Diesel power at the municipal light and power plant. Application for federal aid has been made. Improvements to the plant will require an expenditure of approximately $50,000.

SAN ANGELO, TEX.—Mayor Brown F. Lee has announced that in the event the engineers now employed make a favorable report on the project of constructing a municipal electric light and power plant here no election will be held for the purpose of issuing bonds on the project. He declared that if any bonds are issued by the city commission to finance a municipal light plant they will be bonds based upon the earnings of such a plant and upon such earnings alone, and no revenues will be taken from the taxes to pay either interest or principal of such bonds.

RADFORD, VA.—At a cost of approximately $146,000 a municipal hydro-electric plant is to be constructed on Little River near Radford. The Radford City Council, upon being informed that the Federal Power Commission has issued a license for the plant, promptly met and awarded a contract for building the dam and constructing and equipping the power house.

AMHERST, OHIO.—In its efforts to establish a municipal light plant the village won a second battle last week when the Ohio Supreme Court dismissed the appeal of Allison E. Nichol, a taxpayer who had sought to enjoin the village officials from awarding a contract for machinery. In a previous legal battle the village won its contention that an ordinance proposing construction of the light plant was not subject to a referendum. Mr. Nichol contended the contract could not be awarded as the Board of Control had changed the plans. The village had owned its distributing system for several years, but purchased its current from a private company. It may now go ahead and construct a generating plant.

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I.C.I. Committee Meets

Notable progress, in co-operation with the International Committee on Weights and Measures, toward the adoption of an international primary standard of candlepower and toward the elimination of color differences in photometry were reported at the annual meeting of the United States National Committee of the International Commission on Illumination. L. B. Marks was elected honorary president, U. S. National Committee. E. C. Crittenden and G. H. Stickney were re-elected respectively as president and secretary-treasurer.

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Relocation Costs Disputed

In building the new city railway Newark, N. J., relocated both telephone and electric power lines at its own expense, hoping to collect from the utility companies involved at a later date. Mayor Ellenstein now threatens to sue the Public Service Corporation for $720,000 and New Jersey Bell Telephone Company for $80,000, since both have declined to pay such costs.

▼

Mexico May Federalize Utilities

President Rodriguez of Mexico has been granted, by the National Chamber of Deputies, "facilities for enacting legislation which will federalize electric light and power services in the country with the object of ending monopolies of such services by large companies and materially reducing tariffs for consumers."

▼

Tulare Valuation Review

Application of Southern California Edison Company, Ltd., for a writ of review in the decision of the California Railroad Commission placing a valuation of $228,000 upon the company's distribution system in the city of Tulare has been granted by the California Supreme Court. The company based its application upon the fact that two of the commission members dissented, holding that proper consideration had not been given to the question of severance damages.

Applying Motors Most Effectively

By D. K. FROST

Mattison Machine Works, Rockford, Ill.

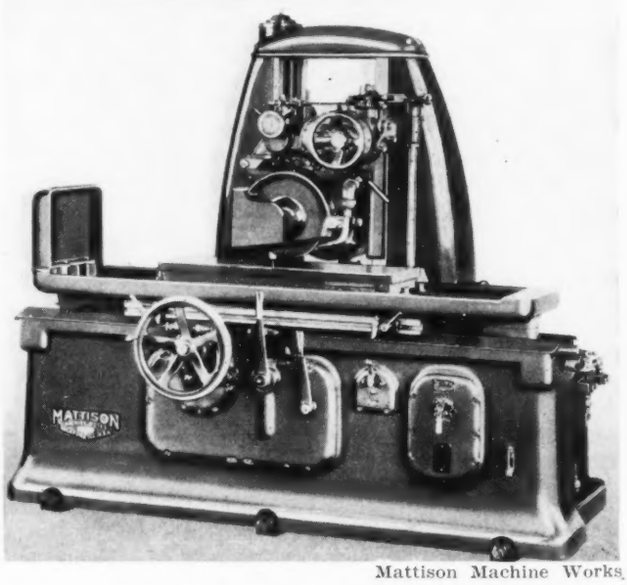
ELECTRICAL equipment is the heart of the modern machine tool. Instead of installing it as an afterthought, as has often been done in the past, the machine should be built around the electrical equipment. The appearance of the completed machine and the convenience of its operation depend upon the initial planning of motor mounting, control and accessory arrangement and wiring. All the electrical parts should be so placed that there will be minimum runs of wire between them and so no wiring will be unnecessarily exposed. These details must be planned when the contemplated machine first goes on the drafting boards. It is in the first stages of the design that the electrical man can be of utmost importance to the machine designer. Here he can help to produce machines which are not only correctly motored but also correctly controlled and wired. The aim should be to have the machine pleasing in appearance, but, more important, to have the electrical apparatus fully protected from any cause and, at the same time, readily accessible for inspection and replacement.

In the selection of motor equipment it is well to keep in mind that probably 90 per cent of the machine shops in this country have only alternating current available. Consequently this discussion will consider only such equipment. This will confine the motors considered to the constant-speed type and to the multi-speed type with two, three or four fixed speeds. Any further changes or adjustments of speed would be obtained through gear reductions and pick-off gears for speed variation. Desirable degrees of motor inclosure, preferable forms and styles of application and discussions of motor characteristics will be presented.

Motor types and their uses

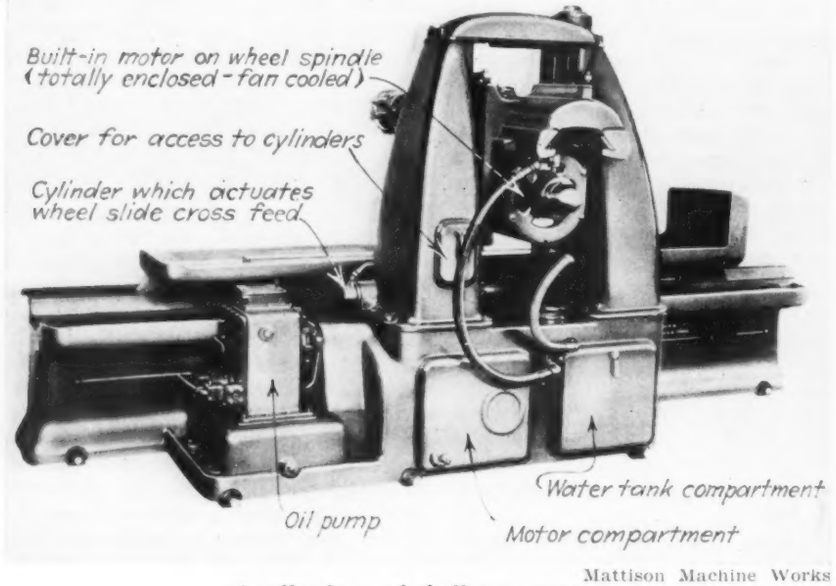
Various degrees of motor inclosure are available:

1. Ordinary open-frame motors.
2. Semi-inclosed motors with top half solid and bottom half perforated, covers over the end shield openings, the frame being open.
3. Pipe-ventilated with separate blower for the cooling air. The ventilation in this case is directly over the windings, the air being taken from a clean source.
4. Self-ventilated, pipe-connected. This is practically the same type except that the fan is mounted on the motor shaft.
5. Totally inclosed with no ventilation.
6. Totally inclosed, fan-cooled.



Mattison Machine Works

The motor on the spindle of the large surface grinder on the left is rated 25 hp. at 1,200 r.p.m.; on the smaller surface grinder, 15 hp. at 1,800 r.p.m. Both are the inclosed, fan-cooled type. After eighteen months' operation an inspection was made of the 25-hp. motor windings. They were as clean as the day the motor was first installed. The stator core of this motor can be removed by an unskilled workman in fifteen minutes. A good mechanic will remove it in five minutes. It is only necessary to remove four bolts holding the end plate in place on its rabbet fit. Two setscrews, holding the stator in place, are then removed, the leads disconnected and the stator is ready to draw out. At least as much time as this would be consumed in taking down a gear-connected, foot-mounted motor, of which the two inner holding-down bolts are generally very hard to get at and often require a special wrench. After taking down the foot-mounted motor it must itself be torn down if it is necessary to get at the windings. In addition to the 25- and 15-hp. spindle motors on these machines each has two more motors built in. In the larger (left) machine are a 7½-hp., 1,200-r.p.m. motor driving the oil pump and a 30-lb. torque motor for raising and lowering the wheel spindle assembly. In the smaller (above) machine these two functions are performed by a 5-hp. variable-torque, four-speed motor and a 20-lb. torque motor.


Built-in motor on wheel spindle (totally enclosed - fan cooled)
Cover for access to cylinders
Cylinder which actuates wheel slide cross feed
Water tank compartment
Oil pump
Motor compartment

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Applications of shell type motors

on Machine Tools

Where the surrounding air is contaminated with metallic dust the stator windings need protection. The air gap in induction motors varies from 0.008 in. to 0.030 in., depending on the size and characteristics of the motor. This is the only running clearance the motor has. It is here that the magnetic effect is the strongest. In an unprotected motor this air gap space will sooner or later be filled with metallic dust dragged in by the ventilation and held by magnetism. Small particles also become imbedded in the insulation. Bitter experience has taught the trade that inclosed or inclosed fan-cooled motors are greatly to be desired. It is difficult, if not impossible, to sell any other type in the automotive industry.

In the inclosed fan-cooled motor the ventilating air does not come in contact with any of the motor parts other than the outside surface of the motor frame. The strength of the air blast created by the fan allows little or no dust to collect in the ventilating passages. Where there is a possibility of oil or water vapor in the air passages special provision for periodically cleaning the passages should be made. This condition is not ordinary and must be considered as a severe condition and treated accordingly.

Every motor manufacturer in the country now makes totally inclosed fan-cooled motors. It is highly instructive to note that, without exception, these types are all equipped with ball bearings, with adequate dust seals.

Totally inclosed units can readily be used in the case of auxiliary motors, intermittently rated for short-time service, such as traverse motors on lathes, cross-rail motors on planers, etc. Up to 2 or 3 hp. capacity at standard speeds continuous rated motors can be totally inclosed without fan ventilation. Electrical manufacturers are aware that stator windings need protection in certain industries. They should direct the trend toward the universal use of inclosed motors in the machine-tool industry.

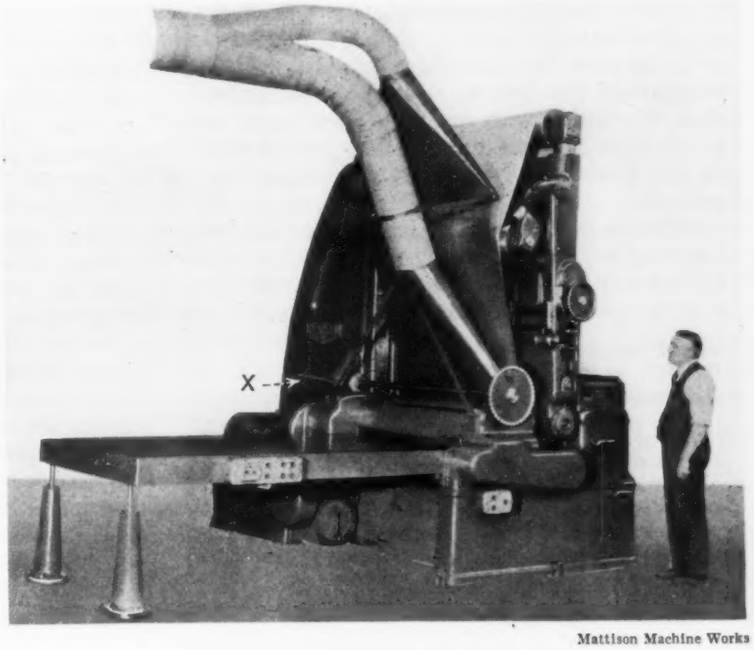
Failure to consider motors, control and wiring as integral parts of machine tools has been responsible for many of the complicated assemblies of mechanical and electrical parts to be found in industrial plants. There are many functions now performed by mechanical or other means which could be done better and cheaper with electrical devices. Machine-tool designers are naturally mechanically minded and think first of mechanical devices. Although motors may be used as the most convenient motive power, many electrical devices which are adaptable to the purpose at hand receive little or no consideration.

As the author of this article points out, close co-operation of an electrical engineer with the designer of the machine is essential from the inception of the design to develop homogeneous units which will meet the user's requirements of simplicity, reliability and ease of operation, inspection and maintenance. In this, the first article of a series, he discusses desirable degrees of motor inclosure, preferable methods of mounting and characteristics that are available for different duties. In later articles he will discuss control and wiring for machine tools.—EDITORS.

Considering the style of application or method of mounting, the following types are available:

1. General purpose, foot mounted.
2. Round frame type without feet.
3. Round frame type with flange for mounting.
4. Shell type, consisting of stator and rotor only, without shaft, end shields or bearings.

General-purpose, foot-mounted motors have been standardized in all mounting dimensions by the National



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The value of the torque motor

The small motor designated x is a totally inclosed, built-in shell-type torque motor used for raising and lowering the entire assembly carrying the abrasive belt. This assembly weighs about 5,000 lb. and slides on the gibbed ways on the main column. This motor is rated ¾ hp., 900 r.p.m., and develops 30 lb. torque at one-foot radius, at standstill. Examining this in terms of a general-purpose motor, it is found that a 3-hp., 900-r.p.m. motor has a rated full-load torque of 17.5 lb. (Formula: $T = \text{Hp.} \times \frac{5{,}250}{\text{RPM}}$ or $3 \times \frac{5{,}250}{900} = 17.5$ lb.) The starting torque of such a motor will be 175 per cent of full load, equaling 17.5 × 175 per cent = 30.6 lb. starting torque at one-foot radius. Here, then, we have a ¾-hp. motor developing the same starting torque as a 3-hp. motor. That, however, is not the whole story. The 3-hp. motor to develop 30 lb. starting torque would draw about 70 to 80 amp. from the power lines. The ¾-hp. motor draws about 24 to 30 amp. to develop the same torque and do the same work. This permits the use of lighter control equipment to accomplish the same result.

Electrical Manufacturers Association. This was a very forward-looking step and has proved of inestimable value to all concerned. The movement should be carried further. The round-frame type has not been standardized, but the round-frame type with flange for mounting has been partially standardized by N.E.M.A. Unfortunately, where the flange is applied to the inclosed fan-cooled type the ventilating air is blown directly into the machine instead of being deflected to the outside. This is not good practice, and there must be modifications of this design before it can be entirely satisfactory. Some machine manufacturers use the standard vertical fan-cooled motor with ring base, but this causes an unnecessary amount of overhang where the motor is applied horizontally. The situation on flange-mounted motors is not satisfactory, although the effort toward standardization of the mounting flange is highly commendable.

The fourth, or shell-type, motor offers a far preferable style of application. These shell-type motors were standardized some years ago for the woodworking machinery manufacturers by several of the principal motor manufacturers. These covered all sizes up to 30 or 40 hp. Since then several motor manufacturers have followed the standardization in the smaller size motors up to 5 hp., but this type of motor has never been standardized by N.E.M.A. These motors, however, were standardized in dimensions for 3,600 r.p.m. and have only in the last year or so been extended to cover ratings at 1,800 and 1,200 r.p.m. There should be a determined effort on the part of motor manufacturers to carry this standardization throughout all sizes and speeds up to at least 30 or 40 hp. at 1,800 r.p.m. and 25 hp. at 900 r.p.m.

Application requirements

It should be recognized that there is no possible way to apply a motor any nearer to its load than mounting the rotor directly on the machine spindle, with the stator built into a housing as part of the machine. Machine-tool builders have hesitated to adopt this type of drive, either because they do not know how simple it is to apply a motor this way, or else the motor manufacturer has failed to push this type of motor. Competitive conditions will force the use of these shell-type motors simply because the application has many advantages and few disadvantages.

Cooling motors by forced ventilation has proved beyond question that greater overload capacity is available than is possible with ordinary open-frame motors. This is especially true on intermittently loaded machines, because the motors cool much quicker during the light load periods.

Consideration of motor characteristics is most interesting. Contrary to ordinary belief, constant-speed squirrel-cage motors can be obtained in many different types for special purposes. Some of the most common types are:

1. General purpose type.
2. Line-start type:
   (a) Low starting torque. (b) Normal starting torque. (c) High starting torque.
3. High-slip type for machines having flywheels.
4. Intermittently rated torque motors.
5. Fast reversing type: (a) Single speed. (b) Two speed.
6. Multi-speed (two, three and four speed), constant horsepower and constant torque:
   (a) Line start type. (b) Single winding, two speed. (c) Two winding, two speed. (d) Two winding, four speed. (e) Three winding, three speed.
7. Geared head type.

When line-start motors first came out the low-starting-torque type was listed as standards. Some difficulty arose in certain applications, where in reality the high-starting-torque type should have been used. The result was that the electrical manufacturers decided to increase the starting torque to a higher average as the easiest way out. For our applications on machine tools we much prefer the low-starting-torque type. They are much easier on the machine and the driving medium (V-belt, chain or gear), as they do not start with any appreciable jerk. They can be jogged or inched to much better advantage. Where it is definitely known that a motor will not be called upon to start under any considerable load, the low-starting-torque type should be preferred. The normal and high-starting-torque types are standard and are carried in stock. The low-starting-torque type must, unfortunately, be specially ordered. The result is that its very good qualities have not been generally discovered by machine-tool designers.

High-slip type motors have exceptionally high starting and accelerating torque. The use of these motors is principally confined to punches, shears, bulldozers and like machines with flywheels. They slip or slow down under load approximately 11 to 12 per cent. This allows the flywheels to pick up and absorb the peak loads by giving up their stored energy. The energy given up by a flywheel is a direct function of the amount that it slows down. If it didn't slow down it couldn't give up energy. After the flywheel has carried through the peak load the energy must be returned to the flywheel by again speeding it up. The high accelerating torque of this type motor restores the expended energy by quickly speeding up the flywheel. This exchange of energy is as rapid as the strokes of a punch press and can only be recorded by an oscillograph.

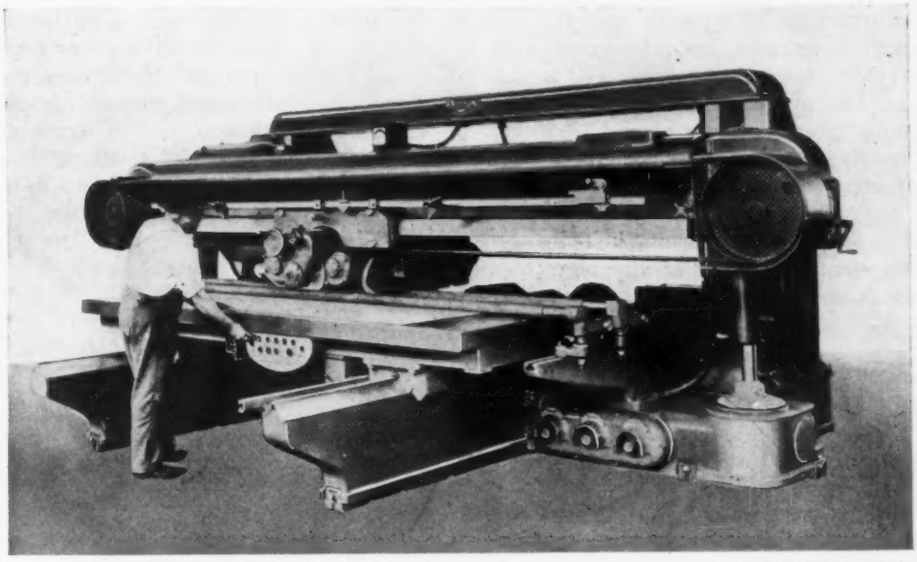
Intermittently rated torque motors are a very useful type. They are generally rated on a five-minute or ten-minute intermittent basis. In other words, they are to be used for not to exceed five or ten minutes and must then be allowed to cool down to ambient or room temperature before again being used. Actually this is not the cycle in which such motors usually operate. Obviously, when they are applied to lathe carriages, cross rails, to raise tables or clamp columns, they will be used only a few minutes at any one time during each day.

Torque motors can be rated on a 30-minute to 60-minute basis. They can even be rated on a basis of one minute on and two minutes off, or, in fact, any definite time on and any definite time off; this cycle to be continuous all day long. As an example, they can be used to move a drill head in at fast traverse, slow down for feed, reverse and move the head out again at fast traverse. These motors will reverse in the twinkling of an eye and accomplish the reversal as smoothly as by any other known means. As a matter of fact, torque motors could be applied where it is present practice to use much more expensive and complicated driving mediums. *Motor manufacturers have been particularly slow in directing the thought of designers toward the use of torque motors for straight line motions, where the movement is beyond the scope of solenoids.* This point will be further brought out when considering motor control in conjunction with thermionic vacuum tubes.

Closely allied with torque motors comes the fifth class, or fast reversing type. By reducing the WR^2 or inertia of rotors, and properly proportioning the torque design,

Motor for fast reversal

This abrasive - belt surface grinder and polisher has a 1½-hp. motor which reverses the spindle motor assembly weighing about 1,500 lb. on a cycle of 35 reversals per minute. This happens to be a direct-current motor, but similar machines are equipped with alternating-current squirrel-cage motors performing the same cycle. These are not experimental machines, but, on the contrary, have been on production work for considerably more than a year with no trouble whatsoever. As closely as can be estimated, a 900-r.p.m. motor of, say, 1 hp. to 2 hp. size can be reversed in between two to three revolutions. A motor running at 900 r.p.m. makes fifteen revolutions per second. This indicates that the motor reverses in less than 2/10 second. On a measured stroke the time elapsed to complete a given number of strokes per minute indicates that this estimation is correct. This machine shows also an example of electrical instrumentation for an operating purpose. The ammeter directly above the operator's position indicates the load on the motor driving the abrasive belt. The purpose is to prevent burning the work by applying too much pressure on it in grinding.



Matteson Machine Works

There are four motors on this machine, of which three are build in: The spindle drive, the drive for reversing the spindle assembly and the torque motor for raising and lowering the complete rail assembly.

motors can be produced which will reverse as often as 30 to 40 times per minute on a continuous all-day cycle. Application of such motors is shown on the abrasive belt surface grinder and polisher illustrated.

The field for multi-speed motors

Multi-speed or step-speed motors, both of the constant-torque type, are available in many combinations of speeds. The constant-horsepower motors are larger than constant-torque motors, because the former develop higher torque at the lower speeds. As a matter of fact, machine tools require as much, if not more, torque at the lower speeds, because the heavy roughing cuts and feeds occur at the slower speeds. The constant-torque type is used for feed works or similar drives where the power required decreases with the speed.

The use of these motors has been somewhat limited because of the control necessary to change speeds. This will be more fully covered in the later article on motor-control equipment. In order to simplify the control problem two-winding, two-speed and three-winding, three-speed motors have been preferred on our machines. These two- and three-winding motors need only individual contactors for each speed, thus permitting simple push-button control. The speeds also may be any desired combination of high and low speeds. On the other hand, in the single-winding or consequent-pole type the lower speed must be half the higher speed. A hand-operated drum controller or a rather complicated contactor arrangement is necessary to change speeds if the single-winding type is used. Otherwise, it is possible to use multi-speed motors to considerable advantage where two, three or four fixed speeds will give the desired results.

Combinations of multi-speed motors with special characteristics or varying degrees of motor inclosure result in motors which must be specially ordered. The only types carried in stock by motor builders are the open-foot mounted type, not of the line-start type above 5 hp. On the other hand, shell-type motors for building into machines lend themselves to any type of winding or degree of inclosure. Special characteristics, or multi-speed windings, can be obtained without reference to other factors.

Geared-head motors are a comparatively recent development. Basically, these motors offer a cheaper way to obtain lower motor speeds. At the same time they are smaller in physical dimensions than slower speed motors of the same rating and speed. Machine manufacturers might justly complain that in the development of geared-head motors there are as many different designs as there are motor manufacturers. No apparent effort has been made to standardize these units. No two are interchangeable in any particular. In some designs the geared unit is made the principle unit to which standard N.E.M.A. motors can be applied. Such units are not close coupled and are wasteful of space. In building gearing into the motor frame motor manufacturers are encroaching on a field normally within the province of the machine builder. The type of gears employed, the bearings and the general rigidity of mounting, however, do not allow any justifiable complaint. These units, in most cases, have gears of ample capacity, are quiet running, well lubricated and protected. Some geared-head units are suitable for horizontal mounting only. Special provision for lubrication and oil seal would be necessary for vertical mounting.

In general, geared-head units will undoubtedly find extensive uses, especially in the fractional-horsepower and small motor field. They offer the possibility of getting large speed reductions at small expense. It must be appreciated, however, that the torque at the slow speed shaft increases at the same ratio as the reduction in speed. Where the initial torque at the motor shaft is small the foot mounting will have ample factor of safety. Where the torque at the motor shaft is considerable and the speed reduction ratio large the stresses set up in the holding-down members should be given careful consideration. Built-in shell-type motors with built-in gear reductions should offer a much more stable design where large torque ratings are involved.

Motor manufacturers should be complimented on the standardization of motor mountings. It should be carried

out further on all types of motors. The further development of bringing out nine leads to the terminal board for ready reconnection from 440 to 220 volts, and vice versa, has proved to be a material benefit to machine manufacturers. There should, however, be a standard designation for three-phase, Y-connected and delta-connected motors. The 220-volt connections for both are the same. On 440 volts the two connections differ, and while a supplementary plate gives the correct arrangement of leads, if the plate happens to be lost, there is no convenient way of telling whether the winding is Y or delta.

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Electric Cast Iron Enters Many Fields

Electric melting and heat treatment have placed cast iron in competition with steel in many uses, said Carl H. Morken, foundry engineer Detroit Electric Furnace Company, in a paper at the recent meeting of the American Society for Steel Treating. "For generations cast iron has been considered an inferior material and was held to be quite unsuitable where strength, ductility and shock resistance were necessary." But now the picture is changed. "During the past two years, a number of startling and revolutionary applications of heat-treated cast iron have been made and others, still more startling, are in the process of development.

"Many parts are now being made from heat-treated cast iron with complete satisfaction. Such parts include underground cable brackets and clamps used in power distribution systems, machinery cams, connecting rods, conveyor chains, dies, gear racks, gears, differential carriers and universal housings for automobiles, and many other similar products. In addition to possessing more than ample shock resistance and elastic limit, these irons are superior to steel in wearing qualities, stress-dampening properties, fatigue resistance and machinability.

"Considerable development work has been done on heat-treated cast-iron camshafts and crankshafts for automobiles, Diesel engines, etc. Camshafts of this material are already in use in at least two automobiles, and it is probable that when this is read at least one automobile will be using heat-treated cast iron crankshafts. The superior characteristics of this crankshaft as compared to the steel forging are lower initial cost, lower machining and finishing cost, better wearing qualities, higher endurance ratio and better stress-dampening properties.

"The future possibilities are tremendous, and because the electric melting furnace has provided the iron foundryman with a tool with which he can accurately produce and reproduce any predetermined composition of iron the metallurgist has been able to establish his system of heat treating the castings. One manufacturer of automotive parts is already producing heat-treated cast-iron parts, replacing malleable iron castings, using a continuous furnace adapted from an idle carburizing furnace. The cycle is less than twenty hours and the procedure is purely routine because the electrically melted white iron castings are of unvarying chemical composition and annealability."

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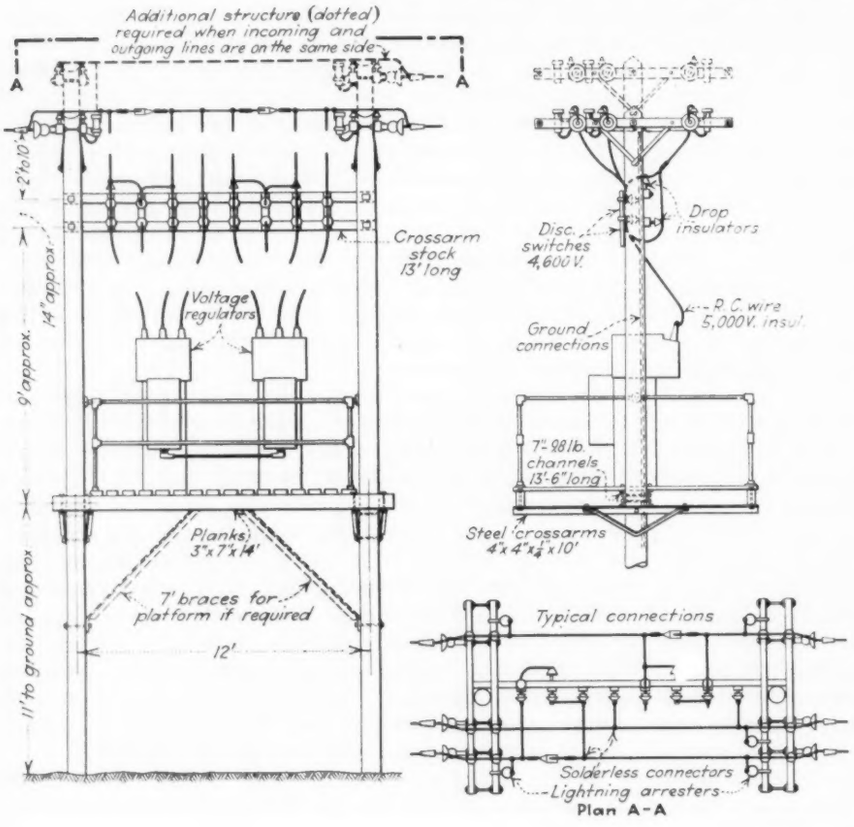
Standard Two-Pole Regulator Platform



Subsidiaries of the New England Power Association are now using the regulator platform design illustrated herewith in standard distribution practice. It is arranged for two units, range 150 to 300 amp. and voltage adjustment from minus 10 to plus 5 per cent. Guys are provided if required by local conditions, and optional provision is made for bypassing the regulators by 4,600-volt disconnecting switches. When these are omitted only one wooden cross-member is required, with drop insulator. Pole lengths are left to the local company. The specifications require installation of a ground connection on each pole with taps to regulator cases, steel channels, railing and lightning arresters. Where soil conditions are poor a four-pole regulator platform may be required, but only two poles are needed in the standard design. Where the distance between the pole top and the cross-member carrying the drop insulators exceeds 7 ft. an intermediate cross-member is required.

Revenue Grows as Days Shorten

September brought the usual upward turn in central station revenue, the total for the country being estimated at $160,080,000, compared with $154,930,000 in August. The rise is equivalent to 3.2 per cent and the amount exceeds that of the revised figure for the month last year by 1.5 per cent, or about the same as in July, though the gain was slightly smaller than in August.

Operating and maintenance expenses rose more than revenue compared with 1932, advancing 4.5 per cent to $68,060,000.

Contrasting with the modest advance in revenue, energy output was 9.5 per cent greater than a year ago, with a total of 6,904,000,000 kw.-hr. It is evident that the increment was chiefly in the field of low-priced wholesale energy, aside from the effect of the gradually declining rates for domestic and small commercial use. The contrast stands out even more prominently if September revenue is compared with August energy output, for which it may be approximately considered as payment, and which exceeded last year's by 13.8 per cent. Average daily output fell off slightly from August to September. The usual change is an increase.

Of the total September output water power contributed 39 per cent. The increase over 1932 was 21.5 per cent, whereas fuel-generated energy increased only 3.0 per cent.

Regional gains in revenue improved over August in the East South Central and East North Central divisions. In the West South Central the preceding month's disparity of 3.6 per cent was considerably diminished. Elsewhere the changes were either negligible or moderately downward.

In making these comparisons it should be recalled that a noticeable upward movement began to manifest itself at the corresponding period last year. It is also to be noted that September revenue was larger this year than that of August, not only in the country as a whole but in each of the geographical regions, although in the West the difference was small. In no case, however, did the rise in revenue over 1932 compare in magnitude with the rise in output.

As to energy output, the Mountain region continues to have the greatest percentage of increase over 1932, followed by the South Atlantic and East South Central. The significance of these changes has been discussed in previous issues in connection with the index of industrial activity.

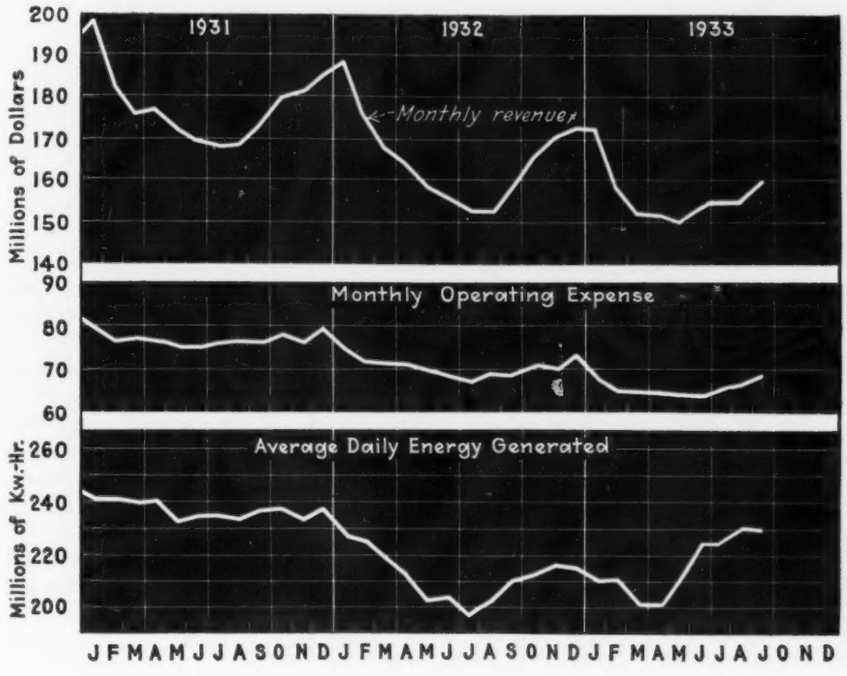


Table I—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1933	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
June	6,791,783	+10.5	2,826,525	+12.7	3,965,258	+ 8.9	1,739,000	+ 7.5
July	7,024,598	+14.7	2,622,724	+ 4.8	4,401,874	+21.7	1,922,000	+12.1
August	7,210,459	+13.8	2,700,903	+12.8	4,509,556	+14.3	1,982,000	+ 7.8
September	6,904,266	+ 9.5	2,710,892	+21.5	4,193,374	+ 3.0	1,994,000	+ 6.2

Table II—Regional Revenue, Energy Output in September, 1933

Compared with Corresponding Month of Previous Year

Region	Revenue		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	160,080	+ 1.5	6,904,266	+ 9.5	2,710,892	+21.5	4,193,374	+ 3.0
New England	16,970	+ 2.1	492,733	+ 8.5	182,577	+ 3.5	310,156	+11.7
Middle Atlantic	40,970	+ 1.2	1,680,696	+ 4.0	537,859	+49.0	1,142,837	− 9.1
East North Central	36,930	+ 2.8	1,601,604	+13.6	101,105	−13.2	1,500,499	+16.1
West North Central	13,360	− 0.1	443,166	+ 5.0	90,014	+ 7.3	353,152	+ 4.4
South Atlantic	18,250	+ 2.8	855,575	+20.7	519,454	+54.0	336,121	− 9.8
East South Central	5,410	+ 3.1	290,949	+11.5	239,886	+15.3	51,063	− 4.2
West South Central	8,900	− 0.6	381,545	+ 6.5	5,823	+16.6	375,722	+ 6.3
Mountain	3,740	+ 0.8	245,717	+25.6	203,527	+37.7	42,190	−11.2
Pacific	15,550	− 0.1	912,281	+ 3.9	830,647	+ 4.2	81,634	+ 0.9

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central-station operations.

Table III—Central-Station Financial Operations in the United States

Compared with Corresponding Month of Previous Year

Month	Total Gross Revenue from Sale of Energy*		Total Operating and Maintenance Expense†	
	1933 Thousands	Per Cent Inc.	1933 Thousands	Per Cent Inc.
June	$153,590	− 0.9	$64,870	− 2.0
July	154,860	+ 1.6	65,590	− 0.1
August	154,930	+ 2.0	66,420	+ 0.8
Sept.	160,080	+ 1.5	68,060	+ 4.5

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.

†Does not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions.

Supplying Service Where Continuity Is Paramount

By FRANK E. SANFORD

Distribution Engineer
Union Gas & Electric Company, Cincinnati

No higher quality of service is required by any industry in its power supply than is demanded by broadcasting stations. As indicated by this article on the supply of power to the new transmitting station in Cincinnati, the maximum opportunities for safeguarding continuity can be capitalized only by joint efforts of the utility and customer. It may suggest how other applications requiring super-service may be handled.

SUPPLY of power to the world's largest broadcasting station, just installed at Cincinnati by the Crosley Radio Corporation, required the provision of several facilities not ordinarily necessary in serving the average customer. Joint consideration of the supply and load requirements has resulted in a close co-ordination of the power equipment of the Union Gas & Electric Company and the customer.

The new transmitter will have a rating of 500,000 watts. To supply the rectifier and auxiliary equipment for this, as well as the present 50,000-watt transmitter of WLW, the 5,000-watt WSAI equipment and the short wave W8XAL transmitter and other broadcasting auxiliaries, a main transformer bank of 2,000 kva. rating is installed. The new transmitter is supplied at 2,300 volts, three phase, the smaller WLW set at 460 volts and the WSAI set at 230 volts. In addition, 115/230 volts, one phase is used for station auxiliaries and lighting.

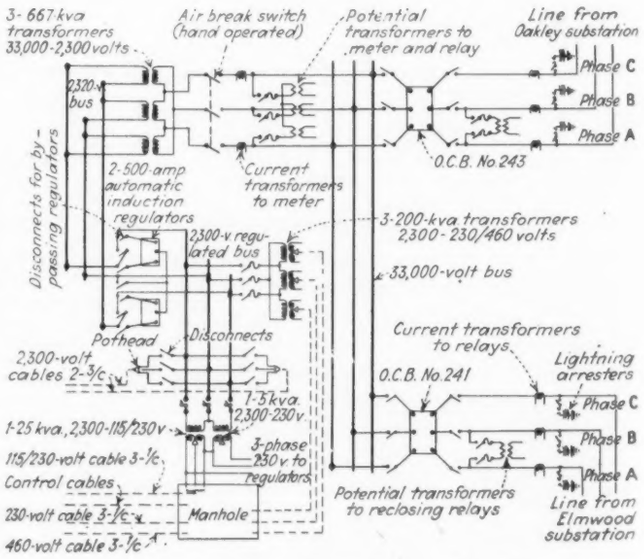
Continuity of service is of extreme importance in the supply to radio broadcasting and to minimize the possibility of interruptions two 33-kv. supply lines are looped through automatically operated oil circuit breakers. One of the circuits is supplied from Elmwood substation and the other from Oakley substation in Cincinnati. Each of these substations is supplied by 13,200-volt underground circuits from the West End power plant and by 66,000-volt lines from the Columbia Park power plant. The 33,000-volt circuits run over widely separated rights-of-way and enter the Crosley station from opposite directions. The WLW transmitter is approximately 25 miles north of downtown Cincinnati.

Emergency switching and bus regulation

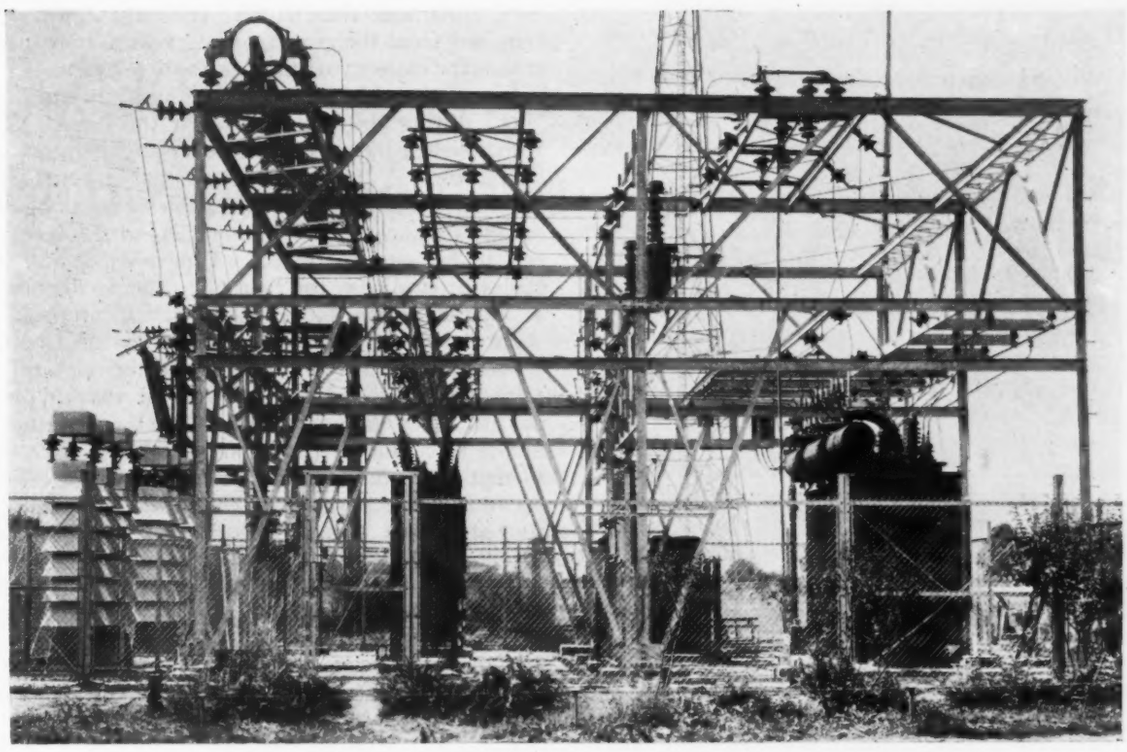
Underground cables are used from the outdoor substation to the transmitter building. All potential and current transformer secondaries and breaker control circuits are carried in underground cables to the transmitter building, where the relay and control panel and commercial meter are located, adjacent to the radio control panels. This gives the radio station operator control of the utility switches so that in case of emergency the system operator can give switching instructions without the necessity of sending a switchman to the station. Position-indicating lights for the 33-kv. breakers are also a part of the console in the main transmitter room.

Regulators on the secondary of the main transformer bank are set to maintain voltage within 1 per cent above or below 2,300 volts. The regulators are connected open delta with mechanical and electrical interlocking. The 230- and 460-volt services are obtained from the same transformer bank as the loads on the two voltages will not be maximum at the same time. Both 33-kv. oil circuit breakers are normally closed, and trouble on either line operates directional relays to open the switch on that line. The breaker is reclosed automatically by synchroverifier relays, when voltage of the proper magnitude and phase angle is restored to the line. If the trouble persists the reclosing feature is locked out after the third trip-out. Service is restored by resetting of the notching relay.

In case of bank or load trouble which carries to the 33-kv. bus totalizing overcurrent relays operate to trip both oil circuit breakers. In this case a lockout relay in series with the overcurrent relay trip circuit latches out the reclosing feature. The operator is instructed to reclose one breaker by hand control, and if the trouble has cleared to reset the lockout relay, when the second breaker will automatically close. To facilitate mainte-



Major elements of outdoor substation supplying four load voltages



Outdoor substation serving new Cincinnati broadcasting station
Includes loop-line switching, transformers and regulators. See line diagram.

nance operations, control transfer switches and hand-control buttons are provided in the substation tower. When the switches are to be controlled from this point the transfer switch removes all control from the switchboard in the transmitter building.

High speed is feature of rectifier switching

The 2,300-volt power supply is connected to the rectifier step-up transformers through a high-speed automatic reclosing oil circuit breaker, a step-start oil breaker and oil breakers for connecting the transformer primaries either delta or Y, for operation at 12,000 or 8,000 volts. This equipment is installed in the transmitter building. There are approximately 120 relays and switches which will operate the high-speed main breaker in case of fault in any part of the transmitter. The time required from the energizing of the trip coil until the arc is extinguished is approximately three cycles.

Some cases of failure, such as gas flashes in the tubes and flashovers due to modulation peaks, are only momentary and the control is such that when these occur the high-speed breaker removes plate voltage and reapplies it in about twelve cycles. On this type of failure the removal of power clears the difficulty and the transmitter continues operation. This twelve-cycle interruption is not noticeable to the listener. In case the failure has not been cleared by the removal of power, the breaker immediately removes power a second time and an elaborate isolation switch automatically isolates the unit of the transmitter containing the fault, and power is again applied to the transmitter for operation at slightly reduced value. This complete sequence, including isolation and restarting of the transmitter, takes place in about 30 cycles. In case the fault is of such a nature that it cannot be isolated the breaker will open a third time and remain open. Push-button control of this breaker also permits operator's control of plate voltage.

When the main rectifier breaker first closes there is a bank of resistors connected in the 2,300-volt circuits to the rectifier transformers. The step-start oil breaker shorts out these resistors after about ten cycles. Thus, the power is applied to the transmitter in two steps. The oil breakers for connecting delta or Y are controlled by buttons on the operator's control desk. They are interlocked so that they only operate when the main breaker is open.

Power supply for transmitter tubes

Approximately 200 kw. is used for lighting the filaments of the twenty 100-kw. transmitter tubes, three motor-generators supply the 4,500 amp. at 33 volts required for these filaments and 75-hp., 2,300-volt motors, each with independent control circuits, drive the three 1,500-amp. generators. The outputs of these generators are paralleled on the main-filament bus with suitable controls to divide equally the load between the three generators. A master control on the operator's console enables him to control all three motors and generators simultaneously and to regulate the voltage on the filament bus.

Plate supply for the transmitter is provided by a rectifier delivering a normal output of 100 amp. at 12,000 volts. A newly developed mercury-vapor rectifier tube is used in this rectifier. The high-level class B modulation system used in this transmitter imposes an unusual requirement on the power supply, inasmuch as the load varies with modulation or loudness of the program. The plate supply load may vary from 1,000 to about 1,500 kw. at syllabic frequencies. Since voltage regulators cannot operate fast enough to maintain exact voltage under

this condition, careful consideration of the power supply reactance was essential.

Alternative plans considered

Before these arrangements of the power equipment were decided upon several alternative plans were considered. Transformation directly from 33,000 to 8,000/12,000 volts for the main rectifier supply would have offered some advantage over the step-down and step-up plan used. In this case switches on the main bank secondary, for delta or Y connection, would have been used. This plan complicated the voltage regulating and switching plans and an additional bank for 33,000 to auxiliary supply voltage was also required.

Alternative physical arrangements of the equipment included placing all switching and auxiliary transformers together instead of part in the outdoor structure and part in the building. Locating the 33-kv. breaker relay and control switchboard in the transmitter building, instead of in a special switch-house, offered a number of advantages and was also justified on a comparison of cost estimates. The control battery is also located in the building and also serves for the 2,300-volt rectifier switch control and the 230- and 460-volt switch tripping. It is jointly owned and maintained by the power company and the customer.

The author is indebted to J. A. Chambers, technical supervisor for the Crosley Radio Corporation, for assistance in preparing this description of the power supply.

▼

Channel Shapes Solve Bus Problem

By C. W. SHANNON

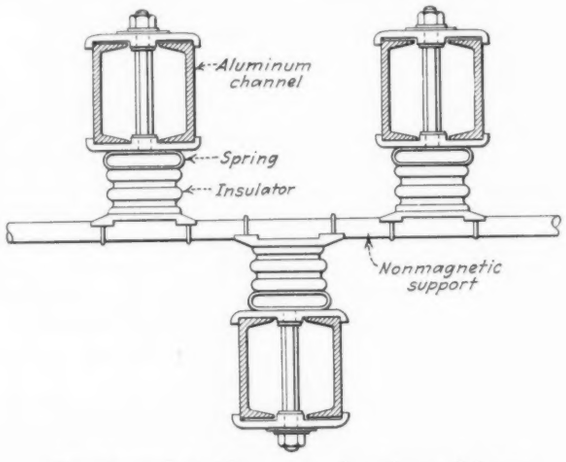
Securing busbars of ample current-carrying capacity for low-voltage generating units was a problem that has been very satisfactorily solved in the generating station of a Middle West industrial plant. The installation had consisted of five turbo-alternator units having a capacity of 6,160 amp. at 440 volts, serving about 1,000 motors of from ¼ to 100 hp. Two sets of ¼-in. x 4-in. copper bars had been used for the main generator buses to increase the free radiating surface. When it became necessary to increase the generating capacity a 600-kw. turbo-generator was replaced by a 2,500-kw. unit and the bus load thereby raised to 9,010 amp. Then the problem of increasing the size of the buses so as to carry the new load gave some real concern. Calculation indicated that to add more bars to the buses as installed would increase the heating of the inner bars and give but little increase in current-carrying capacity.

At this time results of tests showing the advantages of channel-type bus construction became available and the benefits were so clearly evident that a layout was immediately requested. The channel bus could be had in either copper or aluminum, of course, requiring a larger size of aluminum or a greater weight of copper, and aluminum could be had in great lengths while copper was then available only in limited lengths. Because the aluminum could be obtained without splices and because of its lesser weight, a bus made up of three pairs of 8-in. aluminum channel was chosen. The copper bars removed from the generator buses were to be used to increase the capacity of the distribution buses.

Six of the eleven feeders in this plant had to be kept "hot" during the replacement of the buses. This was accomplished by selecting one turbo-generator to supply them power. Its breaker was disconnected from the buses and attached to heavy cables run along the floor on 2x4's adjacent to the disconnects of the feeders which had to be kept energized. Taps were spliced to these cables in readiness for bolting to the feeder disconnects as soon as normal bus supply was discontinued. Only a short shut-down was necessary for the changeover.

A window in the basement at the end of the bus structure facilitated the removal of the old buses and the placing of the new ones. While the buses were going in the disconnects for the new machine were installed, so that when the connections from the generator breakers to the new buses were completed the plant could be started up. A second shut-down of about 30 minutes was required, while the temporary cable connections were removed and the breaker leads again installed, and the start-up on the new buses was carried out without a hitch. With the disconnects open on the new machine system, the installations of the new breaker and the leads from the generator to the switch could be made with the plant in operation.

Since an oil circuit breaker could not be obtained of sufficient size for the 2,500-kw., 440-volt, 3,750-amp. turbo-generator, an air break unit had to be used. The manufacturer's leads from the generator to the switch consisted of twelve 1,250,000-circ.mil cables, and to have carried such leads over to the switch in any neat, rigid manner would have been indeed difficult. Here again aluminum channels were made use of, but in this instance the runs were not straight. Pairs of 6-in. channel were mounted in triangular form, some of the pairs making as many as five turns, these joints being mitered together and welded. While these welds are not as strong mechanically as the original material, they are as good electrically, and the amount of force necessary to get the welded sections into place left no doubt as to the welds having sufficient mechanical strength.



Simple and rigid support for channel buses

The three phases are arranged in triangular configuration, on a non-magnetic pipe structure. Between the bus clamps and the supporting insulators are flat oval springs to take up such mechanical surges as might be set up by heavy short circuits.

Extra Duty for the Synchroscope

By JOHN FIES
Dallas, Texas

A MODIFIED standard synchroscope, used in conjunction with standard relays and the starting equipment of a synchronous condenser, permits either automatic or manual synchronization of a 5,000-kva. unit installed in the Temple substation of the Texas Power & Light Company. The part that the synchroscope plays is the most unusual feature, but since it is associated with the starting equipment, operation of the latter must be briefly mentioned.

Closing of a starting switch by the operator or dispatcher starts the following sequence: (1) Oil pressure is applied to underside of main bearings to ease starting; (2) after a short interval a contactor energizes the primary of the wound-rotor starting motor, whose secondary is connected to starting resistor; (3) when the starting current decreases sufficiently a relay causes a second contactor to short circuit part of the starting resistance; (4) after the current decreases again a third contactor shunts another portion of the resistance; (5) at approximately 95 per cent synchronous speed field is applied to the condenser and normal a.c. voltage is established by a regular; (6) the modified synchroscope comes into service, first regulating the speed of the condenser by causing the third starting contactor to open and close to keep the condenser speed as near synchronous speed as possible; (7) when the machine and line frequency are approximately the same and the phase displacement becomes negligible the synchroscope originates an impulse which causes the main circuit breaker to close.

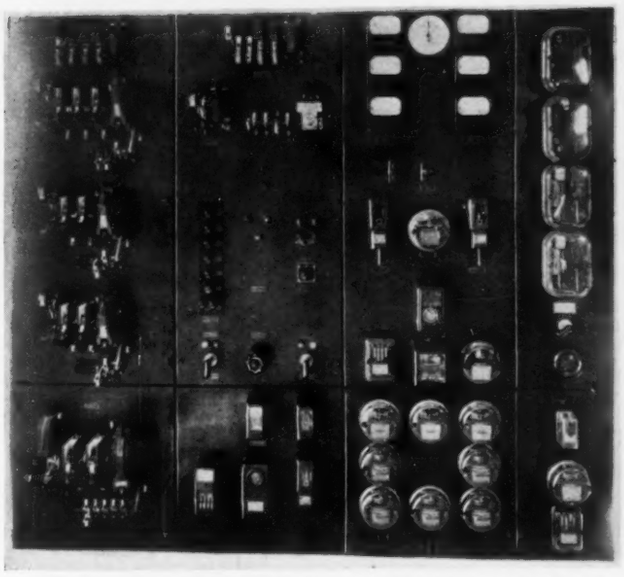


Fig. 1—Control panels for 5,000-kva. synchronous condenser permitting automatic or manual operation

The modified synchroscope is shown at the top of the third panel

To make the synchroscope perform the two last functions, when the rotating disk turns the pin thereon closes contacts *C-B* or *C-A* once per revolution, depending on whether the machine is running fast or slow. These contacts are in the coil circuits of a very light double-pole, double-throw relay which opens or closes the third motor starting contactor, depending on whether the machine is running too fast or too slow. This relay opens its own coil circuits immediately after actuation to relieve the synchroscope contacts of further duty. Contacts *D* and *E* are closed for two short periods each revolution, once before and once after the moment of synchronism. Contacts *F* and *G* are closed for only a short period each revolution (from 7 deg. before to 7 deg. after exact synchronism).

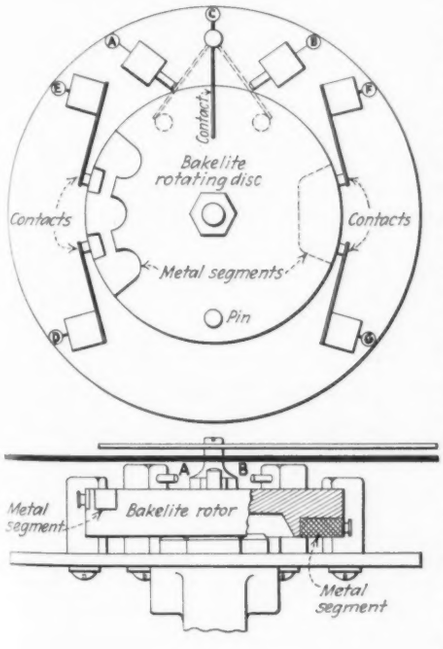


Fig. 2—Elements added to standard synchroscope

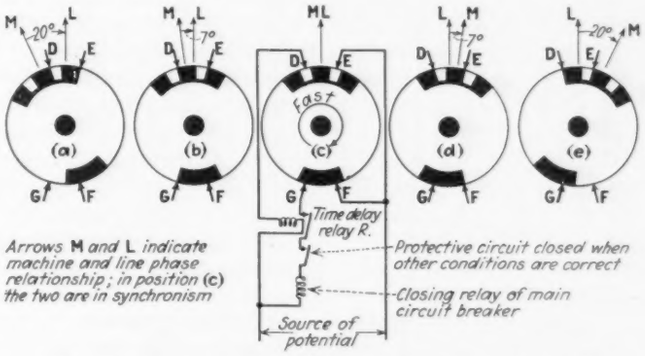


Fig. 3—How the modified synchroscope functions

The machine is assumed to be running fast, although the sequence of conditions would be similar if the machine were running slow. In position A, machine is about 20 deg. from and approaching synchronism; contacts *D-E* are just closing to energize time-delay relay *R*; contacts *F-G* are still open. Relay *R* starts to close its contacts as synchroscope moves to position B, where machine is approximately 7 deg. from synchronism. In this position contacts *D-E* are about to open and de-energize relay *R*, which may or may not have had time to close its contacts, depending on the speed of rotation of the synchroscope. Contacts *F-G* are just closing and one of two things occurs: (1) If the machine and line frequency are about the same the synchroscope disk will be rotating so slowly that relay *R* will have had time to close its contacts, completing circuit through contacts *F-G* and the breaker-closing relay; (2) if machine and line frequency differ sufficiently relay R will not have closed and cannot continue its closing cycle with contacts *D-E* open between position B and D so the breaker will not close as the synchroscope approaches position C, which represents synchronism. Although contacts *D-E* again close at position D, permitting relay *R* to again start its timing cycle, contacts *F-G* open at this position and do not close again until an entirely new closing cycle has started, either as previously described or with the synchroscope rotating in the opposite direction. If the direction of rotation changes very slowly between positions B and D, the breaker closing circuit may be completed while receding from synchronism, but this is permissible as the machine and line frequency are then approximately equal.

tions the rotating element and contacts shown and briefly explained in Fig. 2 were added. Terminals *D–E* and *F–G* are connected as schematically shown in Fig. 3 to close the main breaker under the right conditions. The way in which synchronizing is avoided when there is too great a difference of frequency or when there is too great a phase displacement is explained in the caption.

It should be pointed out that friction is the greatest obstacle to a device of this kind, but it can be made practically negligible by careful design. The pin in the synchroscope disk for operating the speed-matching contacts was displaced 180 deg. from the synchronous position so the torque required to close the contacts would not affect the action of the synchroscope at the point of synchronism.

This apparatus was installed about three years ago and has been operating ever since. Most likely manufacturers now have equipment that avoid the necessity of these modifications and provide simplicity with reliability.

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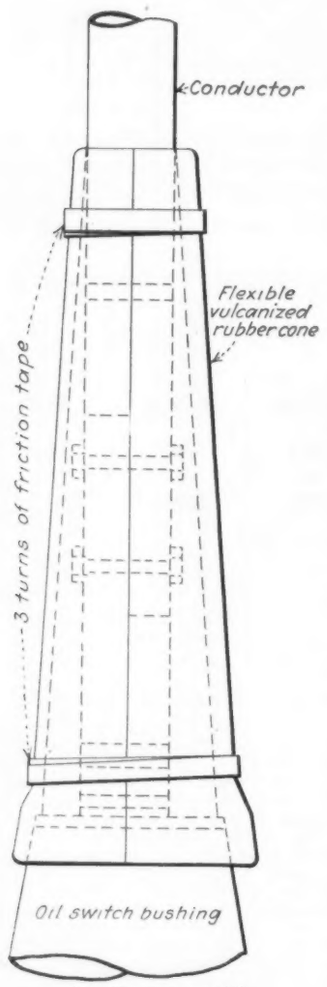
Insulating Sleeves for Truck Breaker Terminals

By H. B. TAVERNER
Commonwealth Edison Company, Chicago



Easily removable terminal sleeve

Note that vertical edges are thinned down to make a neat wrapping job.

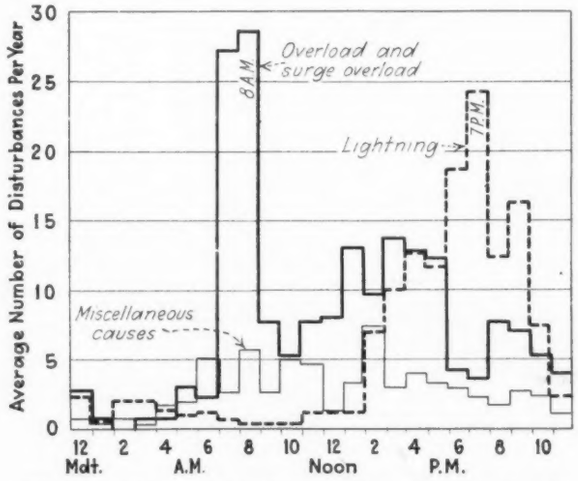
Periodical withdrawal of truck-type oil circuit breakers from their compartments for inspection and maintenance makes it necessary that breaker terminal connections be easily removable to save time and labor of the maintenance man. It is also advisable that the terminals, when the breaker is in the operating position, be protected against accidental contacts. Rats and mice do get into power stations and sometimes get into circuit breaker compartments, with results disastrous to themselves and damaging to equipment.

So the question arises, shall the terminals be left bare so that the connections can easily be removed when the breaker is pulled or shall they be insulated in the usual way and a lot of time and labor spent in unwinding the tape when the maintenance crew comes on the job? Both ease of disconnection and protection of the terminals against accidental contact are accomplished on truck-type breakers up to 15 kv. on the Commonwealth Edison system by means of a wrap-around rubber insulator somewhat like the leather calf protectors favored by army officers. This insulator is a highly resilient piece of vulcanized rubber so formed and stressed as to curl up into the shape of a snug cone of such pitch and diameter as completely to inclose a terminal. These protectors are installed by unrolling them and allowing them to spring back around the terminals as shown in the accompanying sketch.

▼

Most Vulnerable Periods for System Disturbances

To assist in laying out transmission linemen's work the Connecticut Valley Power Exchange recently compiled three years' records of disturbances on the system with respect to time of day at which these occurred and the results are shown in the accompanying chart. Overloads and surges produced the largest number of circuit-breaker openings in any given hour, averaging 28.6 disturbances per year around 8 a.m., reaching about half this number in mid-afternoon and falling off to much lower values at night. Lightning disturbances reached their maximum soon after 6 p.m. and were 24.3 per year at that time. These ran extremely low in numbers in the morning hours and were of far more importance from about 2 p.m. to 11 p.m. Miscellaneous causes of breaker openings were fairly uniformly distributed between 6 a.m. and 5 p.m. A similar study in the lower Hudson Valley showed an early morning peak from surges, one at noon and another about 6 p.m.; the lightning peak was around 4 p.m. and miscellaneous disturbances well distributed through the day between 8 a.m. and 5 p.m.



Classification of disturbances (breaker openings) by time of occurrence 1930-1932 inclusive

Low-Frequency Induction Oven for Baking Enamel

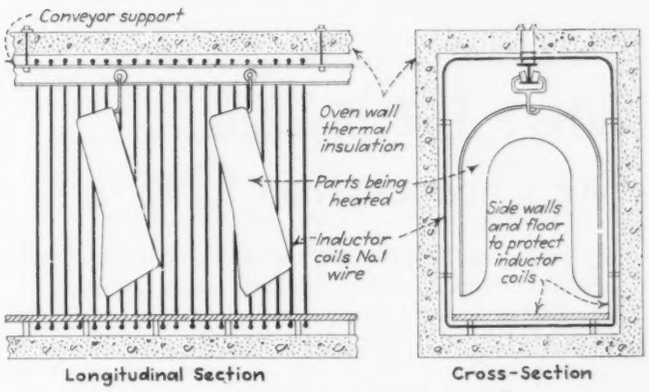
By EDGAR L. BAILEY
Special Electrical Engineer Chrysler Corporation, Detroit, Mich.

MUCH work has been done in paints and pigments to improve and make more pleasing and more nearly permanent the color finishes of automobiles. But, strangely enough, there has heretofore been very little development in the methods used for drying or baking these finishes on the surfaces to which they are applied. With the idea that baking methods could be improved an induction oven was designed and two installations were made in the Plymouth plant of the Chrysler Corporation. Experience with the process and with the two first installations has been so highly satisfactory that use of the new type oven in other Chrysler plants is contemplated for the near future.

The principle used is that of placing the painted iron part that is to be baked or dried in a strong alternating-current magnetic field which produces heat from the hysteresis and eddy currents generated in the part. Thus the paint is dried from the inside to the outside, producing an ideal drying condition, especially on heavy films, leaving a firm, dense coating free from holes or wrinkles. The Plymouth induction ovens are of the conventional tunnel type of insulated wall material with an overhead conveyor chain with hooks carrying the load. The oven is of the modified "A" type which makes an air seal, greatly improving the thermal efficiency and also the working condition at the ends of the oven. The conveyor chain and supports are all of non-magnetic material (bronze-chain and aluminum rails).

The induction coils are ordinary No. 1 copper wire wound in a solenoid around the oven and through which the load hanging on the chain conveyor must pass. The coils are not continuous throughout the oven, but are broken up to make use of a three-phase connection and to produce the greatest heating at the lead end of the oven where the work enters. These coils, being of large section copper, generate very little heat in themselves and are supported by ordinary insulators, in very much the same manner as open-wire work would be handled. A thin barrier wall protects the coils from mechanical damage should something come loose from a hook. A more substantial floor covers the bottom so that the interior of the oven has a smooth finished surface.

Heating of the material going through the oven is not by these coils radiating heat across the large air space, but by the effect of the magnetic field in the painted parts. The parts thus are heated directly by heat generated in themselves. The temperature rises rapidly to that required for the bake; the load then passes into a weaker field where the power input to the part just balances the radiation and holds the temperature constant. The result is that the parts are held 75 to 85 deg. F. hotter than the air surrounding them, with only a small power input.



Induction oven heats work from the inside out

This feature makes possible one of the major thermal economies, as the air that must be removed to carry off the volatiles liberated from the drying paint is at a relatively low temperature. Also, the walls of the oven dissipate only a small amount of heat as the temperature difference between inside and outside air is not nearly as great as would be the case with ordinary hot-air circulation methods of heating. Air discharge from the induction oven is at low velocity and is from the center top, so there is no leakage of fumes or heat from the ends of the oven where the operators stand.

The electrical supply is 360 cycles, three-phase, 250 volts, furnished by a motor-generator set. The power factor of the oven is very low and correction is made by means of static condensers. The baking results obtained are determined by the speed of the conveyor and the voltage on the furnace. These are variable over wide limits so that the method is very flexible to take care of changing production conditions. Another interesting feature is the automatic lowering of the power to the oven when the loading of work goes down. In fact, when there is nothing in the oven no heat is generated except the small amount due to the resistance loss in the inductor coils.

Baking is accomplished in 30 to 50 per cent less time than with ordinary air-heated ovens. The paint drying is complete and satisfactory in every respect and working conditions around the oven are excellent. No fumes or hot air escapes to the room. The fire hazard is almost nil, as nothing about the whole oven is as hot as the painted part that is being baked. No hot resistor or

Operating Data on Induction Enameling Oven

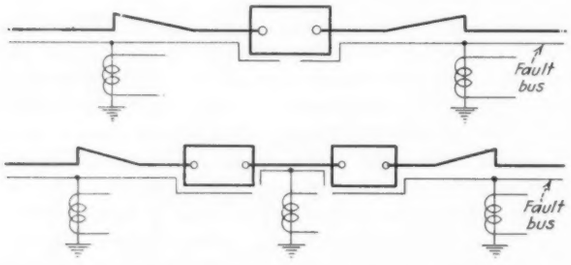
Item	Prime Coat	Color Coat	Total Finished
Capacity (units per hour)	92	92	92
Temperature of bake (deg.)	300	180	.....
Time of bake (minutes):			
with new oven	40	30	70
with original air oven	60	55	115
Material	Rimco Primer	Lacquer	.....
Production (June)	37,204	37,204	37,204
Power used (kw.-hr.)	16,334	8,220	24,554
Power cost at 0.9 cent per kw.-hr.	$147	$74	$221
Power cost per shell	$0.0039	$0.00197	$0.00587
Power cost per ton	$0.78	$0.394	$1.17

flame is used in any way. Maintenance is surprisingly small. There is nothing that is deteriorating, apparently. The outfit should be just as good ten years from now. The efficiency of the process, in spite of the motor-generator loss, is very high, due to heating the work only. Ordinarily tons of air are heated to a temperature of 50 to 75 deg. above the temperature required for the bake and a considerable portion is discharged at this high temperature. This loss is greatly reduced in the new oven.

▼

Where Two Breakers Are Cheaper Than One

Regarding the 66-kv. switching structure at the Crawford Avenue station of the Commonwealth Edison Company, Chicago, there arose some misgiving as to the extent of bus shutdown from fault-bus operation in case of a fault between a certain pair of bus sections. These two adjacent sections are very important in the system and it could be foreseen that a tank fault in



Double tie breakers limit bus shutdown to one section

the bus section tie breaker might very easily shut down both bus sections. This was not pleasant to contemplate in view of the magnitude of load that would be affected.

To avoid this possibility it was decided to use two bus-tie breakers in series and treat the connection between them in effect as if it were an unloaded bus section by making it a distinct unit in the fault-bus scheme. The accompanying diagram shows how this was done. The one drawing shows the single bus section tie breaker, a fault in which might shut down both bus sections. The other drawing shows the improved scheme of bus tie with two breakers by which a fault in either will shut down only the immediately adjacent bus section.

Correcting Slow Meter Errors at Low Power Factor

By E. E. KLINE

Superintendent Electric Meter Department, Union Gas & Electric Company, Cincinnati, Ohio

During the calibration of several old-style three-phase, three-wire, two-element watt-hour meters they were found to exhibit such excessive negative errors at 50 per cent power factor that adjustment was insufficient to bring them within the required accuracy limits. Since these meters were still in good condition and accurate at unity power-factor loads, it seemed worth while to make an effort to correct the inaccuracies at the lower power factors. Thorough inspection and test indicated that the current, potential and lag coils were intact and that none of the parts had shifted from their original positions. Apparently the permeability of the electromagnet iron had changed sufficiently with age to cause the observed errors, and the solution to the problem was to find some easy and simple method of increasing the effective size of the lag coil. However, insufficient clearance existed for the installation of an auxiliary lag loop on the potential coil or its pole, while the replacement of the standard lag coil with a larger coil would have necessitated taking apart the entire meter.

Since the current coil was of the two-pole type (wound to produce poles of opposite polarity at the disk gap), a lag loop wound around both current poles would cause the generation of a flux in quadrature with that portion of the potential flux which crossed the disk gap and thus increase the lag of the effective potential flux. The two sections of the current coil would set up emf.'s in opposite directions in this auxiliary loop and their effects would cancel each other. Such a lag loop could be easily slipped through the disk gap from the rear of the electromagnet, tightened in place, and soldered in a very short time.

Several exhaustive trials showed that this was the proper solution, but indicated that it would have to be applied by a cut-and-try method for individual meters. The correction data on several meters altered by the addition of auxiliary lag loops are listed in the accompanying table. One meter, equipped with non-adjustable lag plate, showed an error of 1.4 per cent minus at 50 per cent lagging power factor. The auxiliary lag loops for this meter were composed of three turns of No. 14 wire in series with a standard power-factor-adjustment resistance loop. The meter then showed an error of 0.4 per cent minus on the 50 per cent lagging power-factor test, and the entire resistance loop was available for future adjustments. All polyphase meters of this type are now being equipped with the auxiliary lag coil whenever the test indicates that insufficient provision for either present or future correction or excessive errors on inductive loads is available.

Record of Meters Altered by Addition of Lag Loops

Meter Rating A.-V.-Φ.-W.	Original Errors (%) (All Resistance Out) F.L.	L.L.	50% P.F.	Lag Loops Added Element	Turns	Size Wire	Errors After Correction (%) F.L.	L.L.	50% P.F.	Amount of Resistance Loop Available for Future Adjustment
25-240-3-3	0.3+	0.1−	4.1−	U	1	14	0.2+	0.2+	0.5−	½
				L	1	12				
25-240-3-3	0	0.1−	3.8−	U	1	12	0	0.2+	0.5−	¼
				L	1	12				
50-240-3-3	0.4−	1.3−	1.5−	U	2	12	0	0.3−	0.6+	All
				L	2	12				
15-240-3-3	0.6−	0.1−	1.3−	U	2	10	0.2−	0	0.3−	½
				L	2	10				
50-240-3-3	0.7+	1.1+	1.3−	U	2	12	0.2−	0.3−	0.5+	All
				L	2	12				

F.L. = full load. L.L. = light load. U = upper. L. = lower. P.F. = power factor.

How to Remove Popular Misunderstandings of Utilities

Attacks on power industry demand explanations by personnel.

Using facts as return fire against unjust assaults.

The 2-cent rate for all-electric homes should become industry-wide.

DAILY on the street and in the press electrical industry employees meet misstatements and accusations aimed against the power companies. For lack of full information it is frequently not possible to answer these attacks at the time, and occasionally, indeed, the criticisms sound so plausible that the man or woman addressed may even wonder whether or not the industry to which he or she devotes so much energy is a worthy one after all. Addressing the New England System Operators Club at Greenfield, Mass., recently, Samuel Ferguson, president of the Hartford Electric Light Company, detailed various misunderstandings of the power industry which need to be removed from the public mind and by the method of presenting typical questions and "high-spot" replies gave the audience definite material with which to refute unjust attacks and meet honest inquiries. A major recommendation included in the address was that American utilities should quickly establish a promotional rate not exceeding 2 cents per kilowatt-hour for energy sold to the fully electrified home in order to meet the competition of the Ontario Hydro system's practice and stimulate prosperity in the American power industry. Already many Hartford customers' residential bills vary from 2.5 down to 1.7 cents per kilowatt-hour, according to usage, in spite of the added heavy expense of fuel and taxes entering into the cost of furnishing their supply.

In the belief that his specific material will be useful to many other utilities in local sustained efforts to arouse the public to the truth about the power industry's needs, situation and policies, the following quotations from Mr. Ferguson's address are here presented. While the data included are mainly derived from the Hartford company's operations, the answers given to these bona-fide queries leveled at this central station organization and its personnel may readily be adapted to other local situations. Representative questions and answers follow:

Average Hartford stockholder gets $4 a week

Q. How is it that while we are losing our homes in the depression, you continue to make large dividends?

A. Our company is earning this year somewhat less than 7½ per cent on the cost of our property. This would not be considered large for industrial earnings in normal times, but is, of course, much more than other industries are earning today. The reason is this: Other industries in good times earn large returns and lay up big surpluses that carry them over poor times. If they did not, they would be "bust" today, but the law does not permit us to do the same. It says: "You are a protected monopoly supplying a necessity which people must buy whether in good times or bad, and therefore you must never have high earnings," so in good times our earnings are not big like other industries. It follows, of course, that if we can have only moderate earnings in good times, we must continue to have them in poor times as well. Otherwise, no one would be willing to invest his money in power houses and pole lines. It is absolutely essential that this should be done, as how else can we build new lines and power houses which a growing city constantly calls for? Our dividends should be and are liberal, but we always, over a period of years, call on our stockholders to invest more new money than we give them in dividends. Consequently we have to maintain our earnings even if we would like to drop them, which we do not.

The public pictures big earnings rolling into the treasury of a prosperous company and being distributed as dividends to rich people who could just as well get along with less, but this is not the case. The true picture is like this: There are 12,000 people who have turned over their savings to the company to be used in building plant and lines to serve the community. Among these there are, of course, some rich people who own many shares, but most of them are wage earners and people of small means. The dividends they receive represent the wages paid them for the service they have rendered in building the system which serves the community, and it will, I think, surprise you to know the amount of these wages. When you think of $2,000,000 being distributed as dividends it seems tremendous, but when this is divided among 12,000 stockholders, with the result that they receive on the average only $4 a week for making possible our electric service, it does not seem unreasonable, and to reduce this wage would create much hardship among thousands who are dependent upon it for their daily bread.

There is another reason why we should not reduce our dividends if it can possibly be avoided: it is because of the danger of such a course to the continuance of our independent existence. I have for the last ten years fought off the various holding companies who wanted to acquire the company, and have so far succeeded, but if our dividends are reduced the market value of our stock will drop below its real value and this would give the big holding companies the opportunity to buy the stock at less than its true value, and I would be powerless to stop it. So, unless the public wants to see an absentee landlord take control of local affairs, it should not urge us to anything that will make it easier for him to gobble us up.

Two valuations required

Q. Isn't it true that you have two valuations on your property, both requiring to be sworn to, the higher value to base your rates on to customers and the lower one to base your taxes on to the city? Is this practice general among all public utility companies?

A. This accusation is literally true, but the damning inference that might naturally be drawn from the form of the charge is absolutely untrue. Let us see. Of course, we have only one set of books and one value on these books. This value is what the property originally cost, and the law requires us to enter that cost and never change it until the particular piece of property is scrapped, at which time it comes off the books. This book value is reported under oath to the state every year.

The other value to which the question refers is that on which we are taxed. The law says that we shall be taxed on "fair market value." This may be equal to or more or less than our cost.

Take our fleet of 80 trucks and automobiles. On our books they are carried at what we paid for them, but you all know that cost new is not the proper basis for tax assessment. What the assessors do is to take each car and reduce its list price by a given percentage according to age. This practice is familiar to all of you, and it is necessary in order that the assessment shall conform to the requirements of law that it shall be "fair market value," because original cost is obviously not the fair market value of a piece of second-hand personal property, even if to us it is worth all or more than cost. Similarly, other pieces of property besides automobiles, such as meters, transformers and turbines, are assessed, not at first cost, but at a lesser figure representing "fair market value," and thus for such items our assessment values are higher than our book values in most instances because of the fact that land was purchased or buildings erected before the period of high prices. For example, the land on Pearl Street, Hartford, where our main office and substation are located, cost us $83,000. It is reported to the state year after year at the same figure of $83,000, but no one would claim that to be a fair figure to use as a basis of taxation. It is valued by the assessors at $331,000, and we pay taxes on that figure.

Thus the fact that our costs as reported to the state do not agree with our assessment figures is not an indication of moral delinquency, nor an effort to take advantage of the public in the matter of rates. These, naturally, must be based on our costs, which represent stockholders' or bondholders' money and equity devoted to the service of the public.

Reproduction cost but one yardstick

Q. Do not companies base their rates to the public on the estimated reproduction cost of their plants rather than upon the investment actually made for the benefit of the public?

A. There is a great deal of misunderstanding on this question. Reproduction cost has never, to my knowledge, been the basis of rates in any single case. This does not mean that much evidence and argument on reproduction cost has not usually appeared in rate cases, but if you will analyze these cases you will find that this feature is used only to show that the rates asked or complained of are far below what they would be if based upon reproduction cost.

The law as laid down by the Supreme Court is simply that this cost, as well as original cost and many other factors, is one that should be considered and given whatever weight is thought to be appropriate in any determination of a proper rate base.

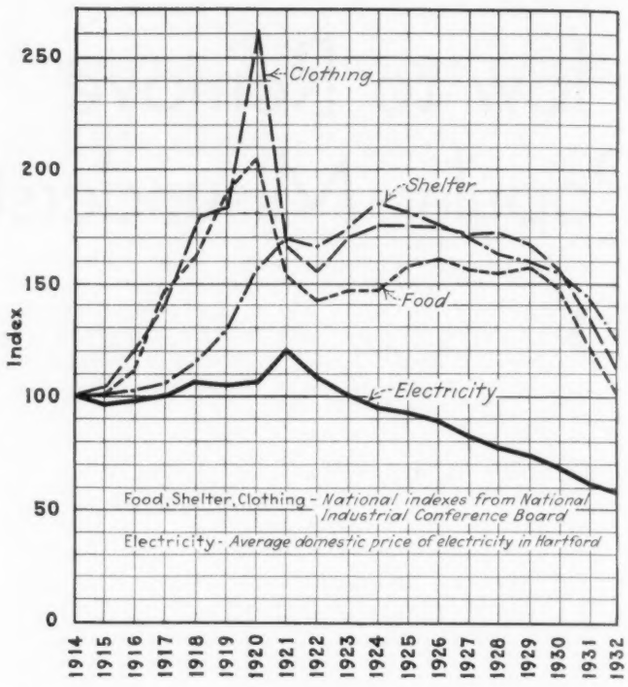
Rates are always based upon business judgment as to what price will give the best results between two definite limits which are: (1) The upper limit—a reasonable return on the value a court might fix as a rate base, and (2) the lower limit—operating cost without any profit. These limits apply to rates as a whole rather than any particular rate. In some cases a particular rate may lie outside those limits, but this should be only temporary and when such departure from the general rule will eventually be a benefit to the customers as a whole, as, for example, a price below cost which will develop a profitable business in time, or a higher price for some particular special new and valuable service to absorb costs otherwise to be allocated to other classes of business.

Two-cent rate demanded for all-electric homes

Q. Is it not true that American companies charge an average price of 6 cents for domestic use when the Hydro Commission of Canada can furnish this service in 250 cities, towns and villages for an average of less than 2 cents per kilowatt-hour?

A. This is true, and to the man on the street it looks like robbery. The answer often given, of the advantage of freedom from taxes and the use of an unique water power, while influencing the situation, is by no means the explanation.

The true explanation lies in the difference in average use and effect of usage in reducing distribution cost. In the United States the average use is about 600 kw.-hr. per year; in Canada, over 2,000. This reduces all fixed costs by more than two-thirds, if figured on a kilowatt-hour basis. This reduction, combined with the elimination of tax and coal bills and a lower wage level, gives the complete explanation of the difference between Canadian and American costs without having to assume any robbery in addition.



Hartford consumers enjoy steadily diminishing cost of electric service

No other necessity of life has fallen so rapidly in price since the war began.

DOMESTIC PRICES

The Hartford Electric Light Company

Year	Average of all Customers	Small Customers Using ½ Average Amount
1921	9.67c per kw.-hr.	10c per kw.-hr
1923	8.07c " "	9.60c " "
1926	6.83c " "	8.44c " "
1929	5.71c " "	7.08c " "
1932	4.72c " "	6.23c "

Reduction in the above period

Electricity	51%	38%
Food	34%	
Clothing	30%	
Shelter	26%	

Q. Why is the average domestic use in the United States so low as compared with Canada?

A. The answer is because of the relatively high price in America. You will note that the answer to this question, combined with the reply to the preceding one, makes a vicious circle of the worst variety. That is: Cost high because of small use—small use because of high price.

It will not satisfy the American public to excuse and explain the high price, no matter how valid is the reason. Some way must be found to break the vicious circle. It was broken in Canada fifteen years ago by the simple expedient of making a very low price (one far below the then cost) and making up the deficits from industrial users and by taxes for the period required to obtain the larger use through the stimulus of lower price. Thus, in 1915 the average annual revenue per customer was only $8 (hardly more than enough to pay for the meter and billing alone). Last year the average was approximately $30 per customer. It is obvious that if the $30 per year now received represents cost, as is required by statute, then $8 per year was far below cost, as the difference in the cost between small and large use is negligible when there are no coal bills or other direct "per kilowatt-hour" costs.

This was a simple and effective way to break the circle and I should be glad to adopt it if I could only find some one willing to

carry the bag through the lean years that necessarily must elapse while the load is coming up. Not finding any one so disposed, we must do the next best thing and offer rates which are reasonable for liberal use. By reasonable I mean that a completely electrified house should be offered a rate of 2 cents or less for the entire requirements of light, cooking, refrigeration, hot water, etc.

This is an idea which has not yet received general recognition, but in my opinion it must come quickly, otherwise the public will compel us to reduce our rates radically. And when the public is aroused it will not discriminate as between large users and small ones, but will make the same low rate to all regardless of the inequity of such a procedure which compels liberal users to pay the losses involved in serving small users below cost.

Why all companies should not see the need to follow this course is something I cannot understand. At Hartford we find much more profit in the all-electric homes earning rates as low as 2.0 cents per kilowatt-hour than we do in the average home at 4.5 cents, or the small user at 8 cents, and certainly the users are more pleased.

A good illustration of the beneficial effect of high usage at low prices is the revenue received from our employees as a group. The employee rate at Hartford is a 33⅓ per cent discount from the regular schedules, which are of a promotional type. This encourages liberal usage, and as a result the average payments of the group are $3.83 per month. This is 25 per cent more than the general average of all customers, and this in spite of (or because of) the fact that as a group the employees earn a rate in their homes of 1.98 cents per kilowatt-hour, as compared to a general average of 4.5 cents.

In the case of this employee group we followed ten years ago exactly the Canadian plan of making a price below the cost for the then small use, trusting to the stimulant of low price to bring up the usage to a profitable figure. We could do this because the group was relatively small and the losses would not be felt on the other classes of business, but it is an impractical course to follow with all customers as the losses would be too heavy to be absorbed by other classes, and if not absorbed would impair the company's ability to pay its interest and dividend obligations during the developmental period.

Q. Why do electric companies conceal their distribution costs? Production cost is generally known within reasonable limits; why not let the distribution cost per kilowatt-hour be similarly known?

A. This is a campaign cry of Governor Pinchot. The answer is that "there ain't no such animal." Production costs and transmission costs being the cost of bulk operations are relatively constant and readily determined for any company, depending wholly on the cost of equipment, supplies and labor modified by the operating efficiency of the company.

Distribution costs, on the other hand, are almost wholly dependent upon the characteristics of the individual customer receiving service. This is because in any given territory it makes far more difference how many customers there are to the mile and how much each uses than does the cost per mile of the distribution circuit—whether it is a little more or a little less. This is illustrated by the distribution cost in the six companies with which I am connected:

Variations in Distribution Cost in Six Utilities

	Customers per Mile	Kw.-Hr. per Customer per Year	Distribution Cost in Cents per Kw.-Hr.
Company A	93	682	2.7
Company B	16	812	5.0
Company C	58	507	4.6
Company D	8	678	9.2
Company E	6	780	8.5
Company F	10	596	8.7
Town A[1]	18	1,338	3.0
Town A[2]	39	436	5.8
Town B[1]	14	1,543	3.1
Town B[2]	40	481	5.2

It would, of course, be possible to average all these figures, but the result would be meaningless and incorrect if applied to any territory having different conditions of density and usage. For those who are mathematically inclined and wish to obtain an approximation of the distribution cost in any particular territory served by overhead lines the following approximate formula will be useful:

$$\text{Distribution cost in cents per kw.-hr.} = \frac{552{,}000\,a + 15{,}900\,b + bc}{12\,bc}$$

where a is the number of miles of street served

b is the number of customers

c is the average kw.-hr. used per customer per annum

It is obvious, then, that the companies are not hiding this information, but simply that there is no single figure that means anything at all unless the customer conditions are known and taken into consideration.

Q. Does not the Federal Trade investigation disclose millions of dollars of write-up of values in utility company capitalizations, and do not these increase the prices paid by the consumer?

A. The investigation does show in some cases write-ups of large amounts, but not in the books of the operating utilities. They occur in the books of the holding companies, and therefore do not affect the plant values on which the rates of the operating companies are based.

The holding company and investment trust capitalization and financing has, in many cases where their securities have been sold for cash, been absolutely unjustifiable and an imposition on the investing public. As a consequence, those who bought such securities or who traded sound underlying utility securities for them have suffered grievously, but the customers to date have not suffered at all. On the contrary, they have been the gainers because of the fact that the inflated balloons of the top companies could only survive provided there was a continuous and rapid increase in business, and to produce this increase great effort has been expended in developing new uses of electricity. In many cases rates have been materially lowered to promote this growth, which extended somewhat the time before the balloons were punctured. From both these aspects the consumers gained. My sympathy is entirely with the investor, but the consuming public, sensing a wrong, erroneously feels that the customer is the one hurt.

Q. With labor costs, material costs, fuel costs and costs of every kind gone down, why have public utility rates not come down?

A. Who says that our rates have not come down? Really, it is most discouraging to find that our customers' memories are so short that rate reductions are never remembered longer than six months. I suppose none of our customers can tell how often we have reduced rates during the past ten years, and that none even realize that the rates of last year were materially lower than those of the year before in all but a few cases.

I have had a number of accounts looked up and compared what these paid this year with what they would have paid under rates as they were ten years ago. The percentage difference in favor of today varies all the way from 10 to 75 per cent. Thus, in a typical case, the customer used 432 kw.-hr. in the first five months of 1933 and paid $19.53. If we had not reduced our rates he would have paid $28.92 for the same consumption, or 48 per cent more. In this list which we investigated the greater reductions are in the more numerous class of medium users, the lesser reductions being for very small or very large users. Please note chart of the constantly decreasing price of electricity compared with other necessities of life since 1914.

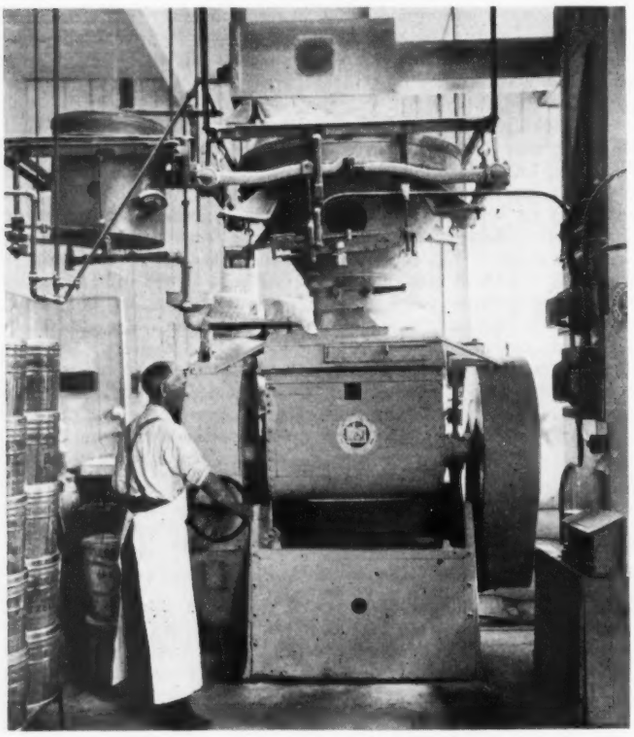
It is true that the drop in the past two years has been more marked in the case of food, clothing and shelter than in electricity, but that is only because electricity has been coming down steadily in both good and bad times, while the others held up to what the traffic would bear while the going was good. As a matter of fact, fuel is the only thing of moment that is cheaper for us this year, and this saving is more than offset by the shrinkage in business and the cost of carrying thousands of customers who cannot pay because of unemployment. Our plant was bought previously and, therefore, fixed charges and depreciation are just the same as formerly.

We will be as glad as our customers when the time comes that we can again reduce, as lower prices mean more business and greater satisfaction to all concerned.

[Mr. Ferguson's answers to other questions will be presented in a later issue.—EDITORS.]

Pretzels All But Twisted Electrically

There never may be a machine capable of giving to a pretzel the characteristic twist that makes it a pretzel, This, the leaders of the industry insist, is because pretzel dough, a mixture of bread and cake doughs, is made up in batches which take about 45 minutes to roll into strips and twist. In that 45 minutes the dough is undergoing a succession of changes in composition. Even could such a substance be twisted mechanically, this



Pretzel dough is weighed electrically, automatically moistened and kneaded electrically

rapidly changing consistency would, it is insisted, defeat any machine very quickly. However, virtually every other process in the manufacture of this companion of beer is electrified now.

One Cleveland manufacturer (the Dan Dee Pretzel & Potato Chip Company) weighs the correct quantities of dry ingredients for pretzels on an electrically controlled balance, mixes the materials in an electric blender driven by a 2-hp. motor, adds the necessary water (weighed automatically) and kneads the mixture to the proper consistency in a motor-driven dough mixer. The prepared dough is then placed in a trough of another machine, which forces it through a nozzle before which revolves a rotary cutter, capable of producing 350 dough-balls a minute. These balls, each about an inch in circumference, are carried across rollers to emerge as foot-long, narrow strips of dough. The strips pass down a long workbench on a canvas-belt conveyor, from which expert pretzel twisters remove them to baking boards on which they are given the pretzel shape.

The uncooked pretzels pass thence into another conveyor system which carries them first through a process solution, then under a salting machine and finally into the ovens. The pretzels are baked from four to eight minutes, depending upon their size; then, to assure removal of any lingering moisture at any one of the three thicker sections (the ends and where the strips cross each other), they are placed in a so-called kiln under a lower temperature for a short additional drying period. The pretzels are then ready for packing and shipping.

▼

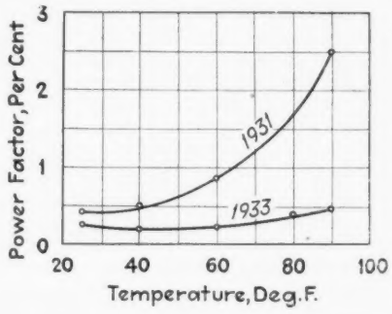
Cable Betterment Will Continue

"Improvements that have been made in impregnating compounds in recent years indicate the possibility of securing compounds which will be stable at somewhat higher temperatures and stresses than are now used for 66-kv cable," said D. W. Roper at the recent meeting of the National Research Council, speaking to the committee on electrical insulation. He continued: "It also appears possible to devise suitable tests to be applied to cable so as to determine whether the insulation will be suitable for operation at these higher stresses and temperatures. With the use of such improved impregnating compounds and test methods the maximum operating temperature of 66-kv. cable, for example, might be raised to about 70 or 75 deg. C., and then the limiting temperature will be determined by the lead sheath or by the design of the manholes. When such a change is made on the 66-kv. cable the maximum operating temperature of the 13-kv. cable will probably be raised to about the same temperature as low voltage cables.

"Some years ago, when the dielectric losses were sufficiently reduced so as to eliminate the possibility of dielectric loss failures, the carrying capacity of the 13-kv.

How cable has been improved

Reduction of insulation power factor from 0.025 to 0.005 in the 13-kv., three-conductor cable of one manufacturer is typical of recent progress.



cables was increased about 50 per cent, resulting in a reduction of more than 30 per cent in the capital charge. When the further increases in operating temperatures as above proposed are in effect there will be a further reduction of about 8 per cent in the capital charge for the 13-kv. cables, while the reduction for the 66-kv. cables would be between 10 and 20 per cent, depending upon local conditions.

"While the recent reduction in dielectric losses of 13-kv. cable, expressed as a percentage, appear rather large, they amount to less than 0.1 watt per foot of cable at the maximum operating temperature of about 80 deg.

For the 66-kv. cables, however, the difference between the highest and lowest values amounts to nearly 0.2 watt per foot of cable at the maximum operating temperature of 60 deg. C., or about 0.5 watt per foot of line. This figure would be increased if the power factor of the 66-kv. insulation should be reduced to the very low figure shown for a recent lot of 13-kv. cable.

"Turning now to the significance of these dielectric losses and insulation failures, we find that for the 13-kv. cable the annual saving due to the reduction in dielectric loss by one maker in the past year amounts to nearly five times the annual cost of repairing cables due to insulation failures; in the case of the 66-kv. cable the possible saving is about fifteen times the annual charges due to insulation failures. Apparently, therefore, the economies of the situation indicate that more attention should be paid to the reduction in the dielectric loss, and, further, that this point becomes of increasing importance as the operating voltage of the cable is increased. If further reductions in power factor of 66-kv. insulation are accompanied by reductions in thickness of insulation, then the reductions in dielectric loss expressed in watts per foot that may reasonably be expected will probably not be more than 25 per cent below the lowest values obtained to date."

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Traffic Lighting Allocation at Boston

In installations of traffic lights the Edison Electric Illuminating Company of Boston contracts with the city of Boston to install the necessary control and service lateral cable and conduit at the municipality's expense. The price is fixed at cost plus 10 per cent, with a fixed minimum price which, incidentally, has in all cases proved greater than cost plus 10. Where spare ducts exist for control cable the company is required to permit their use by the city without charge. Where empty ducts are not available for control cable the city pays that proportion of the cost of conduit which the duct occupied by the control cable bears to the total number of ducts in the conduit line. The Edison company does such portion of the physical work and sublets such part as it sees fit. All other work involved is done by the city.

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Welding Technique Developed for 8½-Ft. Boulder Dam Pipes

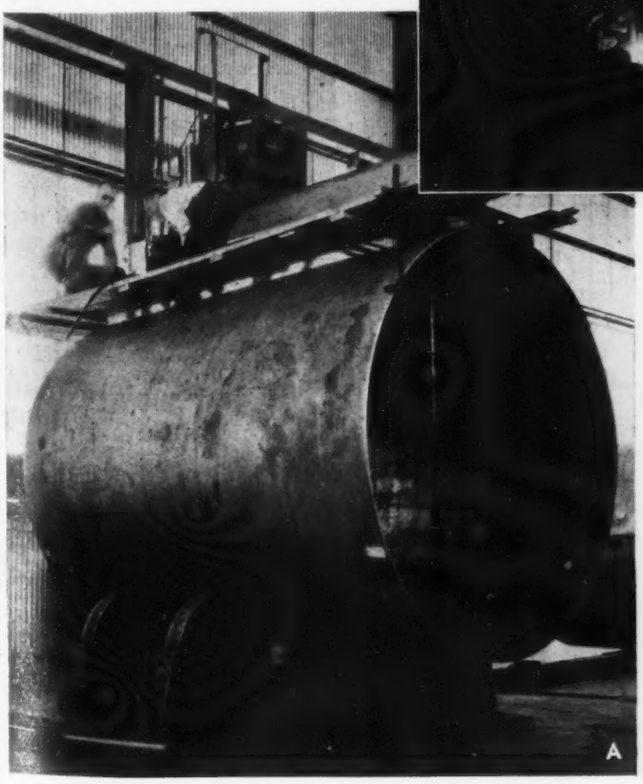
At the field fabricating plant of Babcock & Wilcox at Boulder Dam special means have been devised for mounting the traveling automatic fusion welding machines and for manipulating the pipes during the welding of the longitudinal and girth seams.

(A) Longitudinal seams welded first. Pipe carried on rollers, seams clamped and jacks used to hold circular shape.

(B) Spider holds butted pipes in alignment and acts as a backing member while pipes are rotated and girth seam is welded.

(C) The inside or bottom bead is laid by the automatic welder.

C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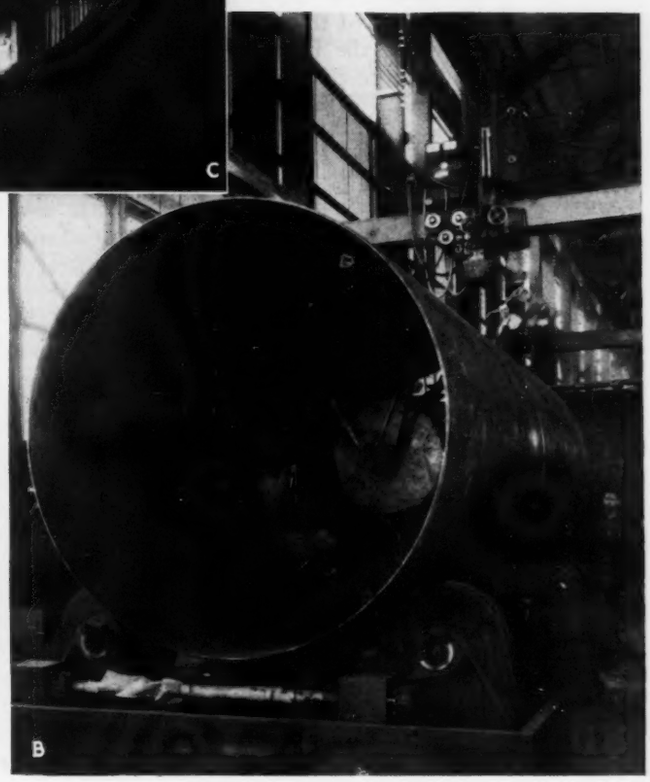
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Timing High-Speed Relays

By J. H. NEHER
Engineering Department, Philadelphia Electric Company

THE development of high speed relays has emphasized the need for a simple laboratory device to measure shorter time intervals than can be measured with any degree of accuracy with the conventional cycle counter or synchronous timer. The device herein described was developed by Walter Van B. Roberts of the Radio Corporation of America and the author primarily with this in view, but it is readily adaptable to the measurement of any time intervals up to about one second by a simple change in the electrical constants of the circuit.

The method employed consists of charging a condenser through a resistance from a constant d.c. voltage for the time interval to be measured and then reading the resultant charge on the condenser by means of a vacuum-tube voltmeter. A definite relationship exists between the voltage built up across the condenser and the charging timer, which can be readily calculated if the values of capacity, resistance and supply voltage are known. The vacuum-tube voltmeter merely serves to enable the measurement of the resultant voltage across the condenser without discharging the condenser during the process.

Theory of Operation—If the charging potential is E and v is the voltage built up across the condenser in the time t the following relation holds:

$$v = E\ (1\text{-}e^{\frac{-t}{RC}})\text{volts}$$

Where C is the capacity of the condenser in microfarads and R is the value of the resistance in megohms, this relationship may be more conveniently expressed as:

$$v = E\ y\ \text{volts}$$

corresponding to a time of xRC seconds, where the relationship between x and y is as given below:

x	y	x	y	x	y
000	000	0.070	0.068	0.140	0.131
0.010	0.010	0.080	0.077	0.150	0.139
0.020	0.020	0.090	0.086	0.160	0.148
0.030	0.030	0.100	0.095	0.170	0.156
0.040	0.039	0.110	0.104	0.180	0.165
0.050	0.049	0.120	0.113	0.190	0.173
0.060	0.058	0.130	0.122	0.200	0.181

The vacuum-tube voltmeter may consist of an ordinary radio vacuum tube such as the UX-112-A with a milliammeter in the plate circuit operated with a fixed plate potential. The current in the plate circuit is a function of the potential of the grid with respect to the filament, and decreases as the grid becomes increasingly negative. When the potential of the grid is at, or negative with respect to, the potential of the negative end of the filament, the internal resistance of the tube between the grid and the negative end of the filament is practically infinite. The relationship between the grid potential and the resultant plate current is readily obtained for the given tube operating with a given plate potential by calibration. It is then a simple matter to connect an unknown voltage between the grid and the negative end of the filament and to determine the value of this voltage by observing the resultant plate current and referring to the calibration curve.

Description of the Device—The schematic diagram of the testing circuit is shown in Fig. 1. The operating circuit of the relay under test is set up in the conventional manner, the circuit being closed by one pole of a double-pole, heavy-duty toggle switch. The contacts of the relay under test are connected to a suitable d.c. source of control voltage through the coil of the "stopping relay." This stopping relay must be as fast and as consistent in performance as possible since its time of operation must be subtracted from the total time of condenser charge to obtain the net operating time of the relay under test. A telephone type of relay having single-pole, double-throw contacts and an operating coil suitable for momentary connection across the control voltage is desirable. For instance, such a relay having a 3,300-ohm coil can be used intermittently with a 250-volt control source and will attain a speed of operation of about 0.0045 second. The coil of this relay should be shunted by a trip coil or its

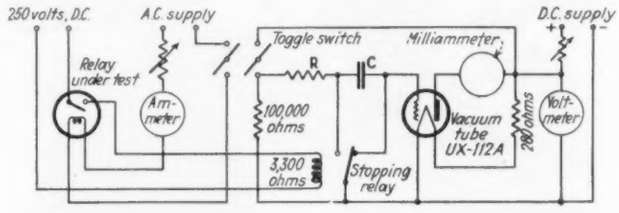
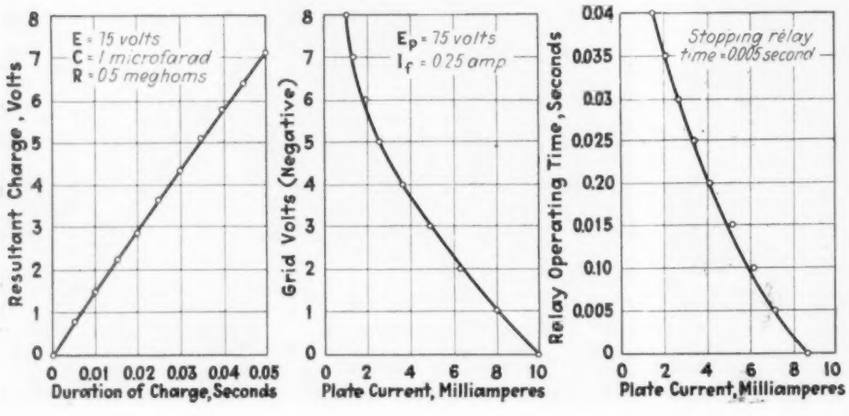


Fig. 1—Schematic diagram of testing circuit


E = 75 volts
C = 1 microfarad
R = 0.5 megohms
Resultant Charge, Volts
Duration of Charge, Seconds
0 0.01 0.02 0.03 0.04 0.05
Ep = 75 volts
If = 0.25 amp
Grid Volts (Negative)
Plate Current, Milliamperes
0 2 4 6 8 10
Stopping relay time = 0.005 second
Relay Operating Time, Seconds
0 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.04
Plate Current, Milliamperes

Figs. 2, 3 and 4—Condenser charging curve, grid-plate characteristic and over-all calibration

The condenser charging curve (left) is for 0.5 second time constant with 75 volts impressed; the grid-plate characteristic (center) is for a UX-112A tube at 75 volts; the over-all calibration is for a 0.04-second range.

equivalent resistance when it is desired to test the given relay under conditions comparable with those to be encountered in service. This will usually be necessary when timing a high-speed power relay since the contacts will bounce unless the holding circuit is loaded to the proper value.

Plate and filament voltage supplies for the vacuum tube are shown derived from a single source, although other arrangements are possible. This source should preferably not be the same as the d.c. control source for the relay under test in order to avoid a drop in plate voltage when the control circuit is loaded by the operation of the relay. The plate voltage to be used will depend upon the type of tube employed, but in case of a UX-112-A a plate voltage of 75 volts will give about 10 milliamperes plate current at zero volts, which is a good working value and which will not overheat the tube. For convenience this same voltage is used to charge the condenser and the filament is also fed from it through a 280-ohm series resistor which permits the proper filament current (0.25 amp.) to flow. A variable resistance is connected in series with the source and this is adjusted to give 75 volts on the voltmeter connected as shown. With this connection a single voltmeter completely supervises the system.

Charging voltage is applied to the condenser C through the second pole of the toggle switch and the resistance R. The circuit is completed through the back contacts of the "stopping relay." When this relay operates it breaks this connection and connects the resistance side of the condenser to the filament. This stops the charging of the condenser, but as the other side of the condenser is connected to the grid of the vacuum tube, the voltage to which the condenser has been charged now appears between the grid and filament of the tube. When the stopping relay is reset the condenser discharges through the resistance R in series with the 100,000-ohm resistor shown. The condenser will be substantially discharged in a period of time equal to ten times the time constant (RC) of the circuit, but this time interval may be eliminated if desired by connecting a discharge key across the condenser terminals.

The condenser may be a high-grade radio by-pass condenser of about 1-mfd. capacity and the resistance R may consist of a high-grade grid leak. The range of the device may be changed at will by varying the value of R, for which purpose a tap switch may be provided. After the values of C and R have been determined by suitable measurements the charging curve can be calculated according to the theory previously explained. Such a curve is shown in Fig. 2.

The grid-plate characteristic of the particular vacuum tube used should be determined by introducing various voltages between the grid and filament and noting the corresponding values of plate current. This relationship is shown in Fig. 3 for a UX-112-A tube operating at 75-volt plate supply. For this particular tube and plate voltage the working range of the vacuum tube voltmeter is about 6.5 volts. For greater grid voltages the curve becomes too flat and the accuracy is impaired.

Operation—The device is operated by adjusting the series resistance in the vacuum tube supply until the voltage indicated by the voltmeter is at the proper value and then throwing the toggle switch. This starts the operation of the relay under test and the charging of the condenser simultaneously. After the stopping relay has operated the plate milliameter will drop down scale and come to rest momentarily at some point indicative of the voltage to which the condenser has been charged. Due to unavoidable leakage of the condenser and its associated circuit the charge will gradually leak away, causing the voltage to drop and the plate current to rise, but with a good condenser and proper circuit insulation the loss should be inappreciable in the time required to make a reading. This will be indicated by the fact that the meter actually stops for a moment before starting up scale again.

The value of grid voltage corresponding to the plate current observed as read from Fig. 3 applied to Fig. 2 will give the over-all time of charge, from which the operating time of the stopping relay must be subtracted to obtain the net operating time of the relay under test.

Operating time of the stopping relay is readily determined by rearranging the test circuit of Fig. 1, substituting the a.c. pole of the toggle switch for the contacts of the relay under test. The reading obtained under this set-up is the operating time of the stopping relay corrected for any difference in operating times of the two poles of the toggle switch. By combining Figs. 2 and 3 and the stopping relay time a single calibration curve may be drawn corresponding to a given time range. This is shown in Fig. 4. With suitable care of the vacuum tube it will be found that its grid-plate characteristic will remain remarkably constant over a period of time.

Usual modifications in the testing circuit may be made with this device to permit the timing of circuit-opening relays as well.

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Huckleberry Swamp Corrodes Tower Footing

While examining the insulator on a certain tower on a 140,000-volt line of the Consumers Power Company in Michigan the patrolman noticed that the top of the tower swayed considerably as a heavy train rumbled by on a nearby railroad track. A close inspection showed the tower anchors to be badly corroded, the smaller braces of the basket type of anchor eaten away, leaving the main anchor post, which was also deeply corroded, as a long unsupported column in the soft muck of a huckleberry marsh in which the tower stood.

As the corrosion extended about 2 ft. vertically corresponding to the variation in water level in the marsh it was suspected that the water had something to do with it. The water was found to be low in mineral content but high in carbon dioxide and organic acids, resulting from decaying vegetable matter. It is not known how long the corrosion had been going on, but as the anchors were set about 1912 it would appear that the galvanized coating withstood the corrosive action for a considerable time. The huckleberries came into the picture when it was learned from horticultural experts at the Michigan State College that the huckleberry bush requires an acid soil. As a result of this experience the patrolmen are making a thorough survey of all tower anchors in swampy soil, with an especially close inspection in locations where there is a prolific growth of huckleberry bushes.

Men of the Industry

A. J. McFADDEN, prominent in California agricultural marketing organizations, has been elected a member of the board of directors of the Southern California Edison Company, Ltd.

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Carl J. Krieger, engineer of wires and cables of Underwriters' Laboratories, with headquarters at the New York office, has resigned to become executive secretary of the flexible cord section, National Electrical Manufacturers' Association.

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GILBERT L. YETTER, formerly materials engineer in the Bureau of Construction and Repair, Navy Department, has been appointed welding engineer for the Bureau of Reclamation, Department of the Interior, assigned to the Boulder Canyon project.

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J. W. McIVER, formerly manager of publicity for the Edison Lamp Works and later sales promotion manager for RCA Radiotron Company, has been appointed sales promotion manager of the appliance division, merchandise department of the General Electric Company, Bridgeport, Conn.

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H. A. MARTIN, formerly chief engineer of the Peoples Light & Power Corporation of New York City, has been appointed division manager of the West Coast Power Company with headquarters in Portland, Ore. Mr. Martin is in charge of the Washington and Oregon properties of the company.

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JOHN H. CLOUGH, formerly assistant to the president of the General Electric X-Ray Corporation of Chicago, has been elected president of that organization to succeed C. F. Samms, who becomes chairman of the board. Mr. Clough, as assistant to the president, was located at Schenectady, where he acted as liaison between the X-ray unit and the research laboratory of the General Electric Company, of which the X-Ray corporation is a wholly owned subsidiary.

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CHESTER A. BINGHAM has resumed his connection with the Alabama Power Company as a member of its law firm of Martin, Turner & McWhorter, after spending several years with power companies in New York. More than ten years ago Mr. Bingham entered the service of the Alabama Power Company. Some time after the formation of Southeastern Power & Light Company in 1924 he was appointed treasurer and moved to New York, later assuming a vice-presidency. Upon the acquisition of Southeastern by Commonwealth & Southern he undertook legal work for that organization.

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HUGH L. RUSCH, who has been connected with the Northern Pump Company, Minneapolis, for the past year and a half, has been elected vice-president and appointed Eastern sales manager of that company. Mr. Rusch was formerly supervisor of the technical data section and of the performance report section with the Johns-Manville Corporation. He is a member of the American Institute of Electrical Engineers.

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JESSE E. LAUDERDALE, formerly sales manager of Curtis Lighting, Inc., Chicago, has joined the commercial staff of the Wisconsin Power & Light Company and will be located in Sheboygan on special lighting work. Mr. Lauderdale had been connected with Curtis Lighting for more than twenty years.

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SIR WILLIAM RAY has been unanimously appointed executive chairman of the Council of the British Electrical Development Association. Sir William will retain his seat in Parliament. He will also remain leader of the London County Council, of which he has been a member for twenty years.

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FRANK C. RAND, formerly general superintendent of the Dakota Power Company in Rapid City, S. D., has recently been appointed general manager of the Gulf Public Service Company with headquarters in Jacksonville, Tex. A graduate of Purdue University, Mr. Rand spent eight years with the Cities Service organization in Denver and Amarillo, Tex., before he entered in 1927 the service of the General Public Utilities Company, of which the Gulf Public Service Company is a subsidiary.

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MILTON M. KAUFFMAN has been elected president of Claude Neon Electrical Products Corporation, Ltd., to fill the vacancy caused by the death of Paul D. Howse. Mr. Kauffman continues as president of the Electrical Products Corporation of California, the chief operating subsidiary. Harry J. Bauer, chairman of the board of the parent company, was named chairman of the board of the California subsidiary, a position to which Mr. Howse was advanced in 1932 when Mr. Kauffman became president of the operating subsidiary.

OBITUARY

Calvert Townley

Calvert Townley, well-known electrical engineer and a former vice-president of the Westinghouse Electric & Manufacturing Company, died suddenly, of a heart attack, November 27 in New York in his seventieth year. A graduate of the Sheffield Scientific School of Yale, Mr. Townley became identified with the Westinghouse Electric & Manufacturing Company at the age of 23, and remained with that organization, with the exception of a short period, until his retirement. During his service with the company he became interested in a large number of utility corporations and in 1904 he left the Westinghouse company to participate in the management of his utility interests. Until 1911 he was consulting engineer for the New York, New Haven & Hartford in planning the electrification of railroad lines leading out of New York. He later returned to the Westinghouse company to become vice-president and assistant to the president. Mr. Townley was a fellow of the A.I.E.E., of which he was once president.

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Kempster B. Miller

Kempster B. Miller, electrical engineer, distinguished especially for his work in the telephone field, died November 22 at his home in Pasadena, Cal., in his sixty-fourth year. Although he was one of the country's leading telephone engineers, his career embraced other fields of engineering, the designing and construction of several hydro-electric plants in Oregon and California being credited to him. For many years he had practiced as consulting, constructing and operating engineer in this country and Canada.

A native of Boston and a graduate of Cornell University in electrical engineering, he spent three years as assistant examiner in the United States Patent Office at Washington. Subsequently he was connected with the Western Telephone Construction Company at Chicago, the Kellogg Switchboard & Supply Company and the Central Union Telephone Company. From 1904 to 1918 he was engaged in practice as a member of the engineering firm of McMeen & Miller, Chicago. At the time of his death Mr. Miller was a director of the Cook Electric Company, the Belden Manufacturing Company and the Kellogg Switchboard & Supply Company, all of Chicago, and the Bend (Ore.) Water, Light & Power Company. He was first vice-president of the Western Society of Engineers and a fellow of the American Institute of Electrical Engineers.